

4. Special Tools, Fixtures and Equipment

A. The following tools, fixtures and equipment are required to complete this repair:

| Description | Quantity | Tool No. | <u>Item</u> |
|---|-------------|----------------------------------|-------------|
| SAL B.495644 (Stage 4 blades) | | | |
| Dies, coining (inc. root location block) Fixture, milling | 1 | s3s.15707000 s3s.15708000 | 1 2 |
| SAL B.495645 (Stage 5 blades) | | | |
| Dies, coining (inc. root location block) Fixture, milling | 1 1 | s3s.15709000 s3s.15710000 | 3 |
| SAL B.495646 (Stage 6 blades) | | - | |
| Dies, coining (inc. root location block) Fixture, milling | 1 1 | \$3\$.15711000 \$3\$.15712000 | 5 6 |
| SAL B.495647 (Stage 7 blades) | | • | |
| Dies, coining (inc. root location block) Fixture, milling | 1 | \$3\$.15713000 \$3\$.15714000 | 7 8 |
| ALL SALVAGES (Stage 4, 5, 6 a | and 7 blade | es) | |
| Fixture, inspection | 1 | s3s.15771000 | 9 |

5. Replacement Parts

A. Not required.



HP COMPRESSOR ROTOR DISK STAGE 1 - REPAIR BY BLENDING TO REMOVE LIGHT IMPACT AND OTHER DAMAGE

MODIFICATION NO. OL.8717C AND OL.8767C

1. Effectivity

| <u>I.P.C.</u> | <u>Fig./Item</u> | <u>Part_No.</u> |
|---------------|------------------|-----------------|
| 72-33-02 | 1 230A | B.916373 |
| | | B.916382 |
| | | 8.922267 |
| | 230C | B.929301 |
| | | в.929302 |
| | | в.929303 |
| | | B.929304 |
| | | B.929305 |
| | | B.929306 |
| | | B.929307 |
| | | в.930693 |
| | | B.930694 |
| | 230D | в.930190 |
| | | B.930191 |

2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT127/B.497538.

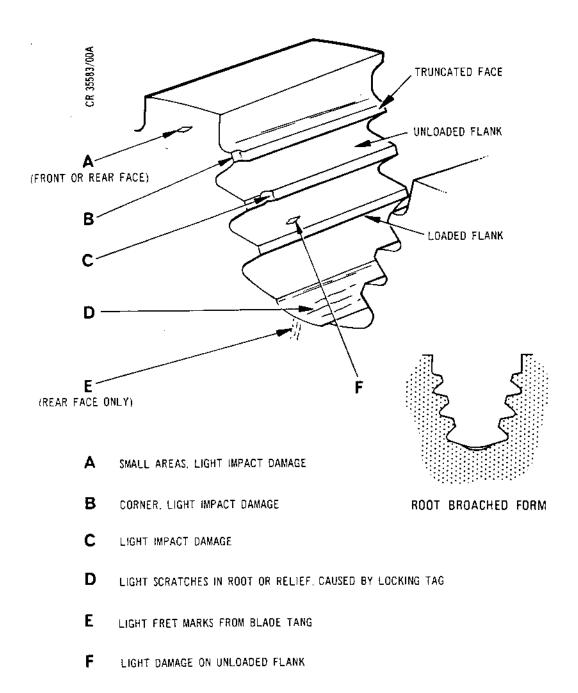
- (1) This repair describes the procedure for removing light impact and other damage from the broached root forms of disks (Ref.Fig.401), by blending using conventional hand tools (Ref.72-09-22 Repair).
- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETERS).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.

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REPAIR

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Typical Damage Forms and Areas Figure 401

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- (6) Operations detailed in this repair procedure that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.
- B. Repair Limitations.
 - (1) Damage to loaded flanks (Ref.Fig.401) is not acceptable.
 - (2) Blend depth maximums are as follows:

Area (Ref.Fig.401)

Maximum Blend Depth (Ref. Fig. 402)

Α

0.005 in. (0.127 mm).

B and C For C, W max = 0.010 in. (0,25 mm) 'W x L' must not exceed 10% of the surface area of loaded flank face.

D and E (Critical Areas) 0.002 in. (0.05 mm).

F

Depth S not to exceed 10% of T.

(3) No blend to extend below XX (Ref.Fig.402).

3. Instructions

- A. Blend and Polish.
 - (1) Hand blend the damaged areas, within limitations, to remove damage, using conventional hand tools and produce radii as required at intersection of blend and flank (Ref.Fig.401 and 402). When blending area B the edge between the disk face and the serration must be radiused. The aim is to produce a radiused form, but a chamfer blended at the corners is acceptable, provided it falls within the dimensions shown in Fig.403 (Ref.72-09-22 Repair).
 - (2) Polish areas blended to achieve a surface finish of 63 micro inches (1,6 micrometers). Area D (Ref.Fig.401) must only be hand polished using fine grade emery cloth.

REPAIR

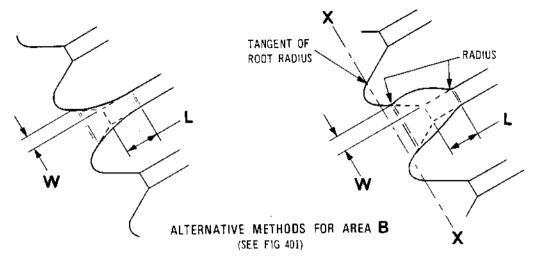
72-33-02Repair No.14

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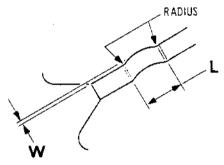


CR 35592/00A

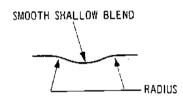


CONVEX RADIUS BLEND

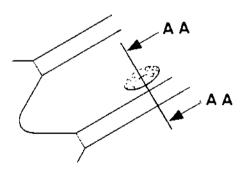
CONCAVE RADIUS BLEND



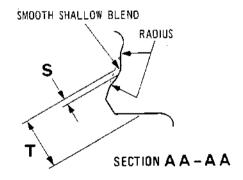
FOR AREA C (SEE FIG 401)



TYPICAL FOR AREAS A AND E
(SEE FIG 401)



FOR AREA F



Blending Details Figure 402

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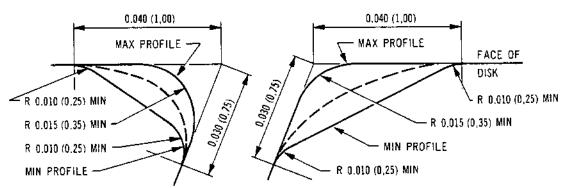
R 0.015 (0.35) MIN
MIN PROFILE -

PRINTED IN ENGLAND

MIN PROFILE

R 0.015 (0,35) MIN

FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS 0.35 (0.90) OR MORE



FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS LESS THAN 0.35 (0.90)

ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN. BROKEN LINES INDICATE TYPICAL PROFILE.

Radiusing Fir Tree Serration/Disk Face Edge Figure 403

REPAIR

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B. Inspect.

- (1) Etch the blended areas in accordance with Chapter 72-09-14, Repair, using solution A. CMT
- (2) Test the blended areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02, Inspection/Check.
 CMT

C. Vapour Blast.

- (1) Vapour blast the etched areas in accordance with Chapter 72-09-13, Repair, using procedure B. CMT
- D. Identify.
 - (1) Using the vibro-percussion engraving technique, Ref. Chapter 72-09-00, Repair, mark on SAL B.497538 or R14 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.
- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None required.

5. Replacement Parts

None required.

REPAIR 72-33-02 Repair No.14 Page 406 Jan 4/93



HP COMPRESSOR ROTOR DISKS STAGES 2 AND 3 REPAIR BY BLENDING TO REMOVE LIGHT IMPACT AND OTHER DAMAGE

MODIFICATION NO.8740C

Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|-----------|---|
| 72-33-02 | 1 300A | B.916375 St.2 B.919889 St.2 B.919946 St.2 |
| | 300В | B.922269 St.2 B.904643 St.2 B.922268 St.2 |
| | , 300C | B.929380 St.2 B.929381 St.2 |
| | | B.929382 St.2 B.930695 St.2 |
| | 2503 | B.930696 St.2 B.922857 St.3 |
| | 350A | B.922858 St.3 |
| | 350B | B.925081 St.3 |
| | 350C | B.925082 St.3 B.929392 St.3 |
| | | B.929393 St.3 |
| • | | B.929395 St.3 B.929396 St.3 |
| | | B.930697 St.3 |
| | | B.930698 St.3 |

Introduction

A. General.

CAUTION:

THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER.

(1) This repair describes the procedure for removing light impact and other damage from the broached root forms of disks, by blending using conventional hand tools.

72-33-02



- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETRES).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (6) Each stage of disk has its own CMT certificate number as follows:

| Disk | CMT | Certificate No | |
|----------------|-----|------------------------------|--|
| Stage Stage | | 128/B.497539 129/B.497539 | |

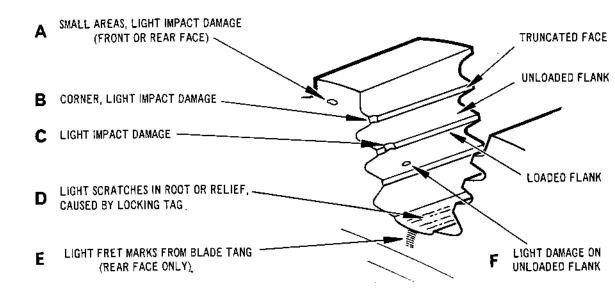
- (7) Operations detailed in this repair procedure that are subject to component Manufacturing Technique Control are identified by the initials 'CMT'.
- B. Repair Limitations.
 - (1) Damage to loaded flanks (Ref.Fig.401) is not acceptable.
 - (2) Blend depth maximums are as follows:

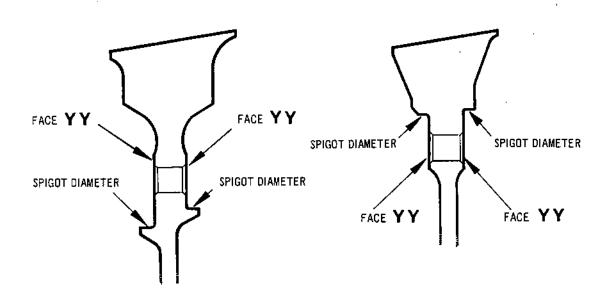
| Area (Ref.Fig.401) | Maximum Blend Depth (Ref.Fig.402) |
|--|---|
| A | 0.005 in. $(0,127 mm)$ |
| B and C For C, W max = O.OlO in. (O,25 mm) | 'W x L' must not exceed 10% of the surface area of loaded flank face. |
| D and E (Critical Areas) | 0.002 in. (0,05 mm) |
| F | Depth S not to exceed 10% of T. |

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CR 35591/00A





Typical Damage Forms and Areas Figure 401

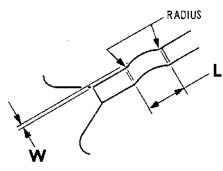
72-33-02
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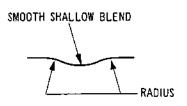
TANGENT OF
ROOT RADIUS

CONVEX RADIUS BLEND

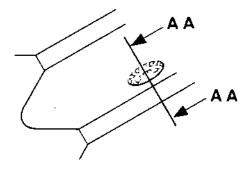
CONCAVE RADIUS BLEND



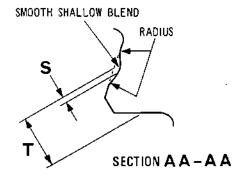
FOR AREA C (SEE FIG 401)



TYPICAL FOR AREAS A AND E
(SEE FIG 401)



FOR AREA F (SEE FIG 401)



Blending Details Figure 402

2-33-02 Repair No.15 Page 404 May 1/80 TN48346



(3) No blend to extend below XX (Ref.Fig.402).

Instructions

- A. Remove Protective Coating.
 - (1) Remove aluminium paint in accordance with procedure detailed in Chapter 72-09-00, Cleaning, using process F.
 CMT
- B. Blend and Polish.
 - (1) Hand blend the damaged areas, within limitations, to remove damage, using conventional hand tools and produce radii as required at intersection of blend and flank (Ref.Fig. 401 and 402). When blending area B the edge between the disk face and the serration must be radiused. The aim is to produce a radiused form, but a chamfer blended at the corners is acceptable, provided it falls within the dimensions shown in Fig. 403.
 - (2) Polish areas blended to achieve a surface finish of 63 microinches (1,6 micrometres). Area D (Ref.Fig. 401) must only be hand polished using fine grade emery cloth.
- C. Inspect.
 - (1) Crack test the disk using the magnetic particle crack detection technique specified for this component in Chapter 72-33-02, Inspection/Check.

CMT

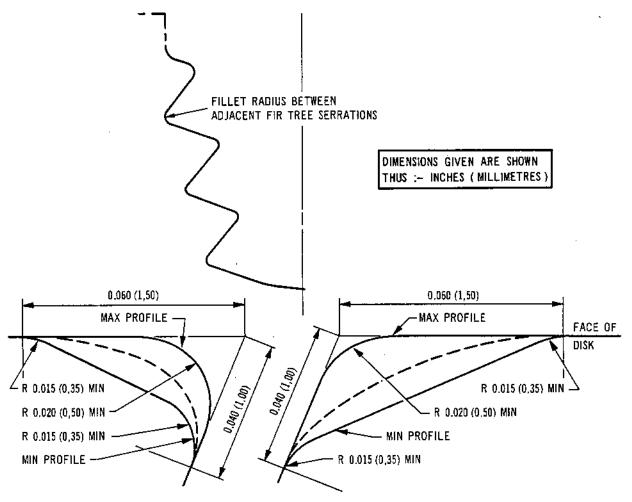
- D. Vapour Blast.
 - (1) Vapour blast the blended areas in accordance with procedure detailed in 72-09-13, Repair, using procedure B.

CMT

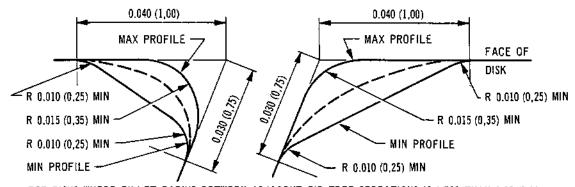
- E. Re-apply Protective Coating.
 - (1) Aluminium paint all over except bolt-holes, faces YY and spigot diameters (Ref.Fig.401), using procedure detailed in 72-09-04, Repair. Painting of blade slots optional.

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FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS 0.35 (0.90) OR MORE



FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS LESS THAN 0.35 (0,90)

ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN. BROKEN LINES INDICATE TYPICAL PROFILE.

Radiusing Fir Tree Serration/Disk Face Edge Figure 403

REPAIR

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- F. Identify.
 - (1) Using the vibro-percussion engraving technique, Ref.Chapter 72-09-00, Repair, mark on SAL B.497539 or R15 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.
- G. Finally Inspect.
 - (1) Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None required.

5. Replacement Parts

None required.



H.P. COMPRESSOR ROTOR DISKS STAGES 4 TO 7 REPAIR BY BLENDING TO REMOVE LIGHT IMPACT AND OTHER DAMAGE MODIFICATION NO.OL.8740C

Effectivity

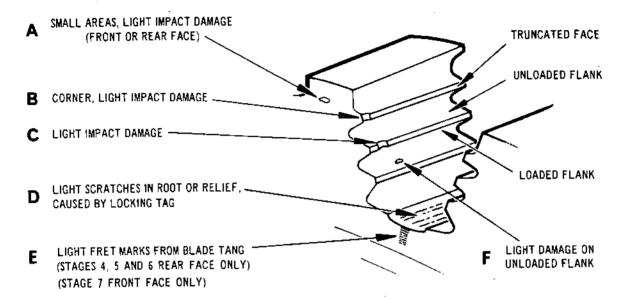
| | | I.P.C. | Fig. | <u>/Item</u> | Part No. | |
|----------|---|----------|------|----------------------|-------------------------------------|-----------------------|
| HGLAMD | 1 | 72-33-02 | . 2 | 20 A 20 B 70 A | 8.922861, B.930779, B.922865, | |
| TED IN E | ı | | | 70B | B.930783, | B.930782, B.930784 |
| PRINTED | | | | 1 20 A | B.922871, B.922873, | B.922872, B.922874 |
| | | | | 120B | B.930785, B.930787, | B.930786, B.930788 |
| | | | 3 | 370C | B.930789, B.930791, | |

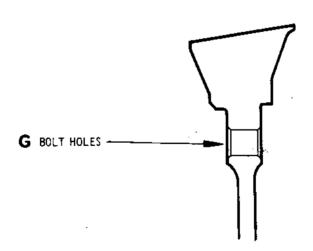
2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER.

- (1) This repair describes the procedure for removing light impact and other damage from the broached root forms of disks, by blending, using conventional hand tools.
- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETERS).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm), unless otherwise stated.





Typical Damage Forms and Areas Figure 401

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- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (6) Operations detailed in this repair procedure that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.
- (7) Each stage of disk has its own CMT Certificate Number as follows:

| Disk | CMT | <u>Certificate</u> | No. |
|-------------------------------|------------|---|-----|
| HP St.4 HP St.5 HP St.6 | CMT CMT | 130/B497540 131/B497540 132/B497540 | |
| HP St.7 | CMT | 133/B497540 | |

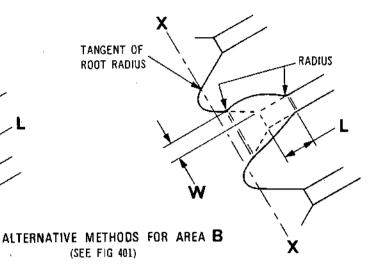
- B. Repair Limitations.
 - (1) Damage to loaded flanks (Ref.Fig.401) is not acceptable.
 - (2) Blend depth maximums are as follows:

| Area (Ref.Fig.401) | Maximum Blend Depth (Ref.Fig.402) |
|--|---|
| A | 0.005 in. (0,127 mm). |
| B and C For C, W max = 0.010 in. (0,25 mm) | 'W x L' must not exceed 10% of the surface area of loaded flank face. |
| D and E (Critical Areas) | 0.002 in (0,05 mm). |
| F | Depth S not to exceed 10% of T. |

(3) No blend to extend below XX (Ref.Fig.402).

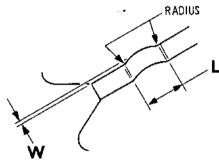
May 1/80



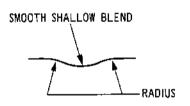


CONVEX RADIUS BLEND

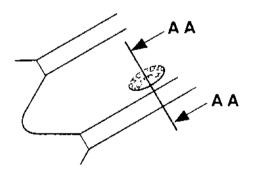
CONCAVE RADIUS BLEND



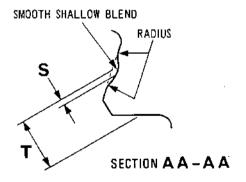
FOR AREA C (SEE FIG 401)



TYPICAL FOR AREAS A AND E
(SEE FIG 401)



FOR AREA F (SEE FIG 401)



Blending Details Figure 402

3-02

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3. Instructions

- A. Blend and Polish.
 - (1) Hand blend the damaged areas, within limitations, to remove damage, using conventional hand tools and produce radii as required at intersection of blend and flank (Ref.Fig.401 and 402). When blending area 8 the edge between the disk face and the serration must be radiused. The aim is to produce a radiused form, but a chamfer blended at the corners is acceptable, provided it falls within the dimensions shown in Fig.403.
 - (2) Polish areas blended to achieve a surface finish of 63 micro inches (1,6 micrometers). Area D (Ref. Fig. 401) must only be hand polished using fine grade emery cloth.
- B. Inspect.
 - (1) Mask of any bolt-holes adjacent to the blended areas to prevent the entry of etching solution.
 - (2) Locally etch the blended areas in accordance with the procedure detailed in Chapter 72-09-14, Repair, using Solution C.

CMT

- (3) Remove the masking from the bolt-holes.
- (4) Locally test the blended areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02, Inspection/Check.

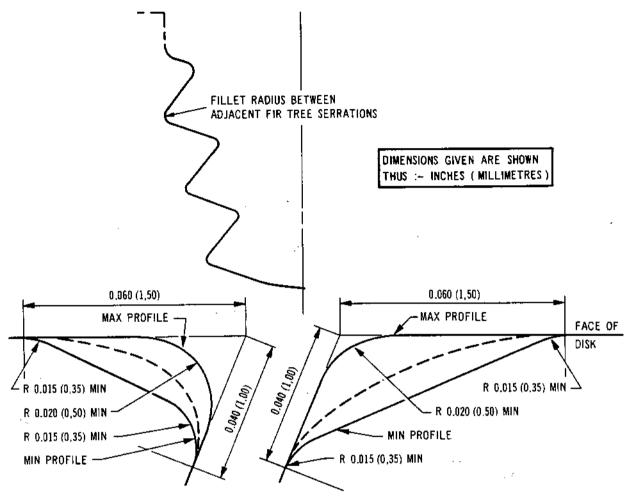
CMT

- C. Vapour Blast.
 - (1) Locally vapour blast the etched areas in accordance with the procedure detailed in Chapter 72-09-13, Repair, using procedure B.

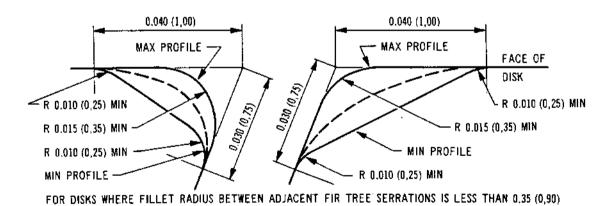
CMT

- D. Identify.
 - (1) Using the vibro-percussion engraving technique, Ref. Chapter 72-09-00, Repair, mark on SAL B.497540 or R16 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.

72-33-02 Repair No.16 Page 405 Jun 1/89



FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS 0.35 (0.90) OR MORE



ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN. BROKEN LINES INDICATE TYPICAL PROFILE.

Radiusing Fir Tree Serration/Disk Face Edge Figure 403

72-33-02 Repair No.16 Page 406 May 1/80



- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None required.

5. Replacement Parts

None required.

72-33-02 Repair No.16 Page 407 May 1/80



SHAFT, DRIVE, COMPRESSOR HP

HP TURBINE BEARING LOCATION RESTORED BY FLAME DEPOSITION COATING

B476039

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | Part No. |
|------------|-----------|-------------------------------|
| 72-33-02 | 3 330B | B923990 B923991 B925461 |
| | | B925462 B935451 B935452 |
| | | B935454 B935455 B935457 |
| | 3A 330D | B935458 B512232 B512233 |
| | | 8512234 8512235 8512236 |
| | | B512237 B512238 |
| | | B512239 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be applied any number of times provided the minimum pre-spray dimensions can be maintained (refer Fig. 402).

REPAIR **72-33-02** Repair No. 17 Page 401

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

NOTE: OPERATIONS 1 TO 4 ARE FOR REPEAT REPAIRS ONLY, FOR NEW REPAIRS PROCEED TO OPERATION 5.

 Completely remove all traces of coating from location XX by chemical stripping and/or machining. Refer TSD 594 OP.107 APP.3. Refer Figs.401 and 402.

 Locally swab etch repair area to ensure complete removal of coating. Refer Overhaul Manual Chapter 72-09-14 Repair, using Solution C.

3) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210

4) Dimensionally inspect.

Refer Fig.402.
Record actual diameter of area ZZ.

NOTE: OPERATIONS 5 TO 11 ARE FOR NEW REPAIRS ONLY, FOR REPEAT REPAIRS PROCEED TO OPERATION 12.

5) Locate component to fixture.

Refer para.7. Tools, items 1 and 2.

6) Locate fixture to machine and set true to Datums.

Refer Fig. 401.

7) Grind area ZZ to the dimensions given.

Refer Fig. 402. Refer para.6a.Data.

- 8) Remove component from machine and fixture.
- Press to remove burrs and sharp edges.

Use hand tools only.

REPAIR

72-33-02
Repair No. 17
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| 10) | Dimensionally inspect | |
|-----|-----------------------|--|
| | machining operation. | |

Refer Fig. 402.
Record actual diameter of area ZZ.

11) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210

12) Mask off all areas except area marked ZZ.

Refer TSD 594 OP.704 Refer Fig. 402.

13) Abrasive blast area marked ZZ.

Refer TSD 594 OP.704. Refer Fig.402.

NOTE: Prior to flame deposition coating calculate, from the dimension recorded in Ops.4 or 10, the amount of bond coating required to achieve a finish machined top coat thickness of 0.004/0.006 (0,10/0,15).

14) Flame deposition coat area ZZ with bond coat to a thickness as calculated above, followed by a top coat applied with sufficient thickness as to reproduce location XX after final machining.

Refer TSD 594 OP.704. Use OMat 3/188 bond coat. Use OMat 3/1140 top coat. Refer Figs.401 and 402.

15) Visually inspect coating for evidence of blistering, lifting, cracking or chipping. Refer TSD 594 OP.704

16) Dimensionally inspect to ensure finish machining dimensions can be achieved.

Refer Fig. 402.

17) Remove masking.

18) Locate component to fixture.

Refer para.7. Tools, items 1 and 2.

19) Locate fixture to machine and set true to Datums. Refer Fig.401.

20) Finish grind location XX to post spray dimensions.

Refer Fig. 401. Refer para.6b.Data.

21) Remove component from machine and fixture.

22) Dress to remove burrs, sharp edges and any surplus spray. Use hand tools only.

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OVERHAUL

Refer TSD 594 OP.704 23) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.

Refer Fig. 401. 24) Dimensionally inspect.

Refer TSD 594 0P.213 25) Dye penetrant inspect component.

Refer Overhaul Manual 26) Mark Repair Instruction number RI B476039 or R17 and coating Chapter 72-09-00 Repair. identity symbols on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

HA WC Coating symbols

5. MATERIAL

> RR CODE COMPONENT MATERIAL

QDY SHAFT, DRIVE, WASPALOY COMPRESSOR HP. MSRR7034

6a. DATA

GRINDING DETAILS (PRIOR TO COATING)

GRINDING WHEEL: A60JV GRIT RANGE 46 - 80 I - K GRADE RANGE :

5000 - 6500 surface ft/min WHEEL SPEED

(25,4 - 33,0 surface M/sec)

88 - 100 surface ft/min (50/56 r.p.m.) WORK SPEED

(0,45 - 0,50 surface M/sec)

0.0002"(0,005) per rev. FEED COOLANT Translucent soluble oil.

6b. DATA

FINISH GRINDING DETAILS

DIAMOND GRINDING WHEEL

180 - 230GRIT RANGE

5000 - 6500 surface ft/min WHEEL SPEED

(25,4 - 33,0 surface M/sec)

100 - 200 surface ft/min (56 - 112 r.p.m.) WORK SPEED

(0,50 - 1,0 surface M/sec)

0.0005" - 0.001" (0,0127 - 0,0254) per rev. FEED

Soluble oil 60/80:1 flood type COOLANT

REPAIR

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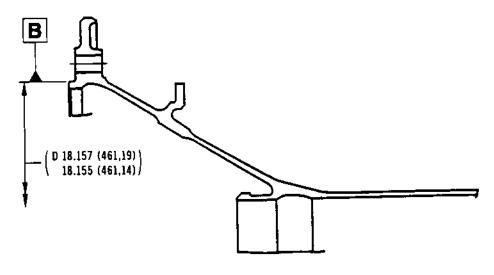
Dec 1/95

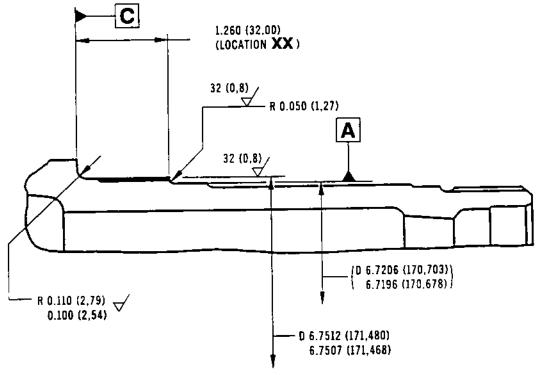


| 7. | TOOLS | | | |
|----|--------------------------------|-------------------------------|-----------------|-------------|
| | TOOL NUMBER | DESCRIPTION | | <u>ITEM</u> |
| | \$3\$13609000 \$3\$13610000 | MACHINING FIXTURE CLAMP PLATE | | 1 2 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | DESCRIPTION | <u>QUANTITY</u> | <u>ITEM</u> |
| | NONE. | | | |

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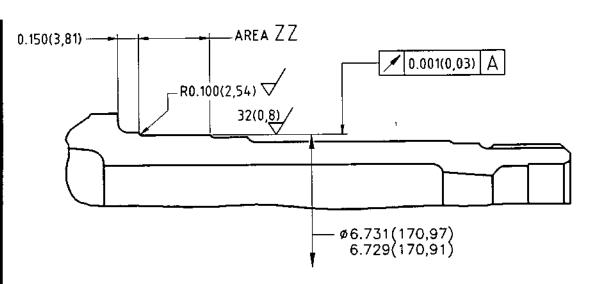


TYPICAL SECTION THROUGH SHAFT FIG. 401.

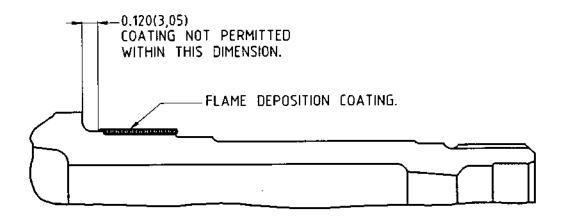
REPAIR

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PRE-COAT MACHINING DETAILS.



FLAME COATING DETAILS.

FIG.402.



HP COMPRESSOR ROTOR - STAGE 2 TO 3 SPACER RING REPAIRED BY BLENDING DAMAGE CAUSED BY BOLT HEADS

MODIFICATION NO.OL.8802C

Effectivity

| I.P.C. | <u>Fig.</u> | <u>/Item</u> | Part No. |
|----------|-------------|--------------|----------|
| 72-33-02 | 1 | 330 | B.922835 |

2. Introduction

A. General

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 134/B.499476.

- (1) This repair describes the procedure for blending damage caused by bolt heads.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) The operations that are subject to Component Manufacturing Technique Control are indicated CMT.
- (5) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (6) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations (Ref.72-09-20 Repair).

B. Repair Limitations

- (1) Maximum depth of blending 0.025 in. (0,64 mm). Referto Fig.402.
- (2) Blending must not encroach into the existing radius. Refer to Fig. 402.

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3. Instructions

- A. Mark Out
 - (1) Inspect and mark out damage marks for machining.
- B. Machine
 - (1) Locate the spacer ring to a rotary table on a milling machine, and clamp securely.
 - (2) Mill to remove the damage, within the repair limitations (Ref. Fig. 402), under the following conditions:

Cutter : 0.500 in. (12,70 mm)

diameter withend radiused

D.1 in. (2,54 mm).

Speed : 350 - 500 r.p.m.

Feed : 2.000 in. (50,80 mm) per

min.

Coolant : Soluble oil 30 to 1

dilution.

Surface finish: 63 micro-inches (1,6 micro-

metres).

CMT

(3) Remove burrs and sharp edges.

C. Inspect

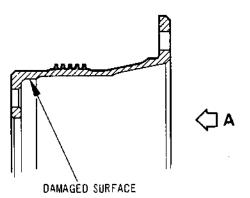
- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Inspect the machined areas for cracks using magnetic particle crack detection as detailed for this component in Chapter 72-33-02 Inspection/Check.

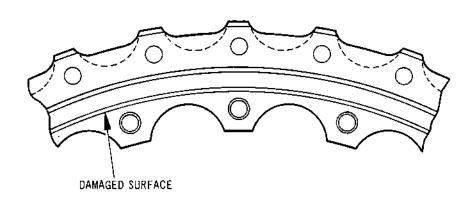
CMT

E. Paint

- (1) Apply high heat resisting aluminium enamel as required:
 - (a) If the enamel has been stripped completely during cleaning prior to repair, re-enamel completely as instructed in Chapter 72-09-04 Repair.

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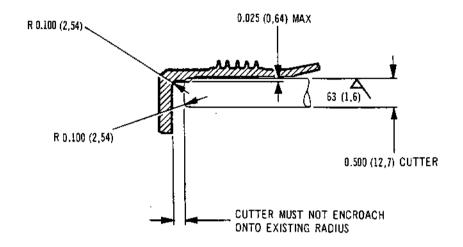


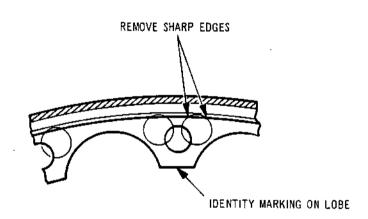


VIEW IN DIRECTION OF ARROW A

Stage 2-3 Spacer Ring Figure 401

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ENLARGED VIEWS OF REPAIRED AREA

SURFACE ROUGHNESS VALUES ARE SHOWN, THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Stage 2-3 Spacer Ring Figure 402

REPAIR 72-33-02 Repair No.18 Page 404 Jul 31/93



- (b) If the enamel has not been stripped completely, use the touch-up technique as instructed in Chapter 72-09-04 Repair.
- · F. Inspect
 - (1) Inspect for the satisfactory completion of the enamelling operation.
 - G. Identify
 - (1) Mark SAL B.499476 or R18 on the adjacent lobe to the existing part number. Do not mark in the scallops. Use electro-chemical marking or vibro-percussion engraving (Ref. 72-09-00 Repair).
 - H. Final Inspection
 - (1) Finally inspect the spacer ring to ensure that the repair has been carried out satisfactorily, and that the spacer ring is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

Replacement Parts

None.



HP COMPRESSOR ROTOR SHAFT FRONT - REPAIR BY REMOVAL OF SCOREMARKS IN BORE BY MACHINING

MODIFICATION NO.OL.8832C

Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|-----------|--|
| 72-33-02 | 1 260B | B.927125 B.927126 B.927129 B.927130 B.927131 B.927132 |
| | 260c | B.930192 B.930193 |

2. Introduction

A. General

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 139/B.499494.

- (1) This repair describes the procedure for machining scoremark damage to the HP compressor rotor shaft front bore.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) The operations that are subject to Component Manufacturing Technique control are indicated by CMT.
- (5) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (6) Details of the tools referred to by item number in this repair procedure, can be found in para.4.

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B. Repair Limitations

(1) Diameter of bore 'B' must not exceed 4.510 in. (114,55 mm) maximum. Refer to Fig.401.

3. Instructions

A. Grind Bore

- (1) Locate the rotor shaft front to the grinding fixture, Ref. tool item 1, then locate the rotor shaft front/ fixture assembly to a suitable internal grinding machine, and set true to datum diameter A (Ref. Fig. 401).
- (2) Grind bore 'B' (Fig. 401) to remove damage with the minimum of metal removal, within the repair limitations (Ref. para. 2.B.) under the following conditions:

Grinding wheel : C60F

Component speed : 35 r.p.m.

feed : 0.00079 in. (0,02 mm)

per rev

Coolant : G.P. Soluble oil

60 to 1 dilution

Surface finish : 63 microinches

(1,6 micrometres)

CMT

- (3) Remove burrs and sharp edges. Remove the fixture from the grinding machine and the rotor shaft front from the fixture.
- (4) Inspect to ensure the satisfactory completion of the machining operation.

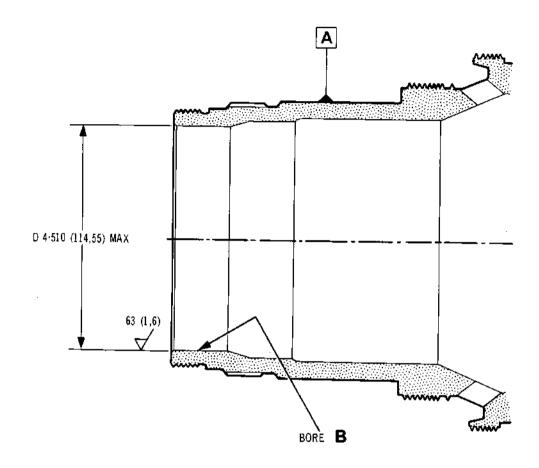
B. Chemically Etch

WARNING: OBSERVE THE WARNINGS GIVEN IN CHAPTER 72-09-14, REPAIR.

(1) Mask off the rotor shaft front using "I.C.I. Stopping Off Red Lacquer" to specification F230/2006. Ensure that only the re-machined area of bore 'B' (Fig. 401) is exposed to the etching solution.

CMT

CR 35975/00A



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Machining Details Figure 401

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(2) Using the etching technique specified in Chapter 72-09-14, Repair, Solution A, etch for sufficient time to achieve the desired surface up to a maximum period of 20 seconds after the onset of gassing.

CMT

C. Inspect

- (1) Crack detect the re-machined area of bore 'B' (Fig. 401) using the fluorescent dye penetrant process F3A as specified in Chapter 72-09-00 Inspection/Check.
- D. Glass Bead Peen Machined Bore (Ref. 72-09-15 Repair)

 (Method (2) or (3) may be used).
 - (1) Apply masking tape to areas which are not to be peened.
 - (2) Locally glass bead peen the re-machined area of bore "B" (Fig. 401) using "AC" wet glass beads with 9N minimum Almen intensity. Peening to fade out from re-machined area.

CMT

(3) Locally glass bead peen the re-machined area of the bore 'B' using 0.00016 in. (0,004 mm) diameter glass beads to DMP 28 - 0.010 in. (0,25 mm) F30N Almen intensity.

CMT

E. Inspect

(1) Inspect for the satisfactory completion of previous operation.

F. Identify

(1) Mark 'SAL B.499494' or 'R19' adjacent to existing part number using the electro-chemical marking technique or the vibro-percussion engraving technique (Ref. 72-09-00 Repair).



- G. Final Inspection
 - (1) Finally inspect the rotor shaft front to ensure that the repair has been carried out satisfactorily and that the rotor shaft front is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Qty</u> | Tool No. | <u>Item</u> | |
|--------------------|------------|---------------|-------------|--|
| Fixture, machining | 1 | \$38.15507000 | 1 | |



HP COMPRESSOR ROTOR - STAGE 2 TO 3 SPACER RING -LABYRINTH SEAL REPAIRED BY PLASMA WELDING

MODIFICATION NO.OL.8835C

1. Effectivity

| I.P.C. | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|----------------------|
| 72-33-02 | 1 330 | B.922835 B.922836 |

Introduction

A. General

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 134/B935523.

- (1) This repair describes the procedure for restoring the inter-stage labyrinth seal by machining the worn labyrinth fins, building up by Plasma Welding, and machining to obtain standard dimensions.
- (2) The operations that are subject to Component Manufacturing Technique control are indicated CMT.
- (3) A test piece shall be produced and subjected to metalurgical examination; test pieces are required initially and upon any change of airline operator, sub-contractor, machine or welding equipment.
- (4) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (5) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (6) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.

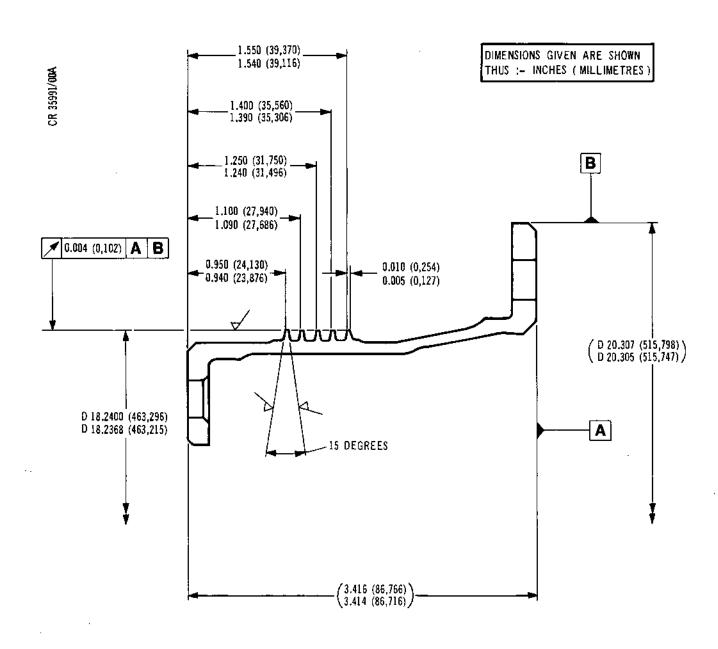
72-33-02 Repair No.20 Page 401 Sep 1/83



- (7) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (8) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (9) Surface texture is to be 125 micro-inches (3,2 micrometres).
- (10) All tools referred to by item number in procedural steps are detailed in para.4.
- (11) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations (Ref.72-09-20 Repair).
- 8. Repair Limitations
 - (1) Distortion must not exceed the limits shown in Figure 404 prior to repair.

3. Test Piece

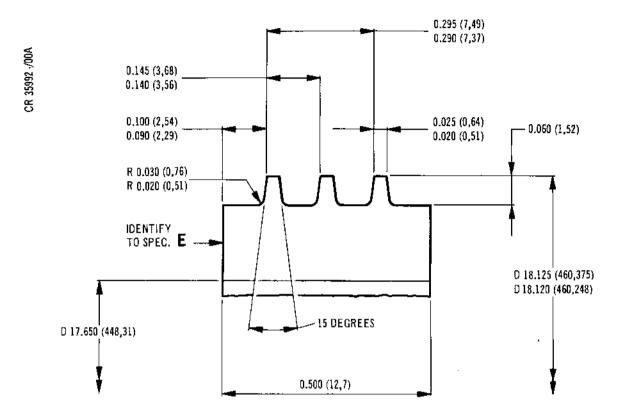
- A. Produce Test Piece.
 - (1) Produce a test piece from fully heat treated MSRR6519 material to the dimensions given in Fig. 402.
 - (2) It is permissible to use an unserviceable standard part as a test piece. In this case, machine the fins to 18.120 in. (460,25 mm) minimum diameter. (Ref. Fig.403).
- B. Plasma Weld Test Piece
 - (1) Build up the labyrinth fins to a minimum height of 0.080 in. (2,03 mm) using the plasma welding techniques. Refer to Fig. 402, Fig. 405 and paragraph 7 for welding data.
- C. Heat Treat Test Piece
 - (1) Heat treat the test piece in a controlled atmosphere at 580 deg C plus/minus 5 deg C for 1 hour. Cool in air.

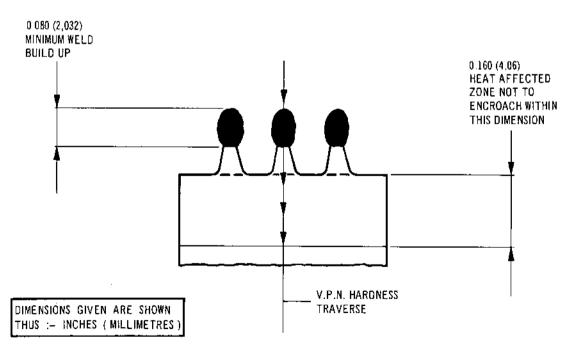


Stage 2-3 Spacer Ring - Standard Dimensions Figure 401

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Test Piece Figure 402

72-33-02 Repair No.20 Page 404 Sep 1/83 D. Metalurgical Examination of Test Piece

NOTE: The following examination must be carried out by the controlling laboratory.

- (1) Produce four suitable micro-sections at 90 deg from the test piece weld surface.
- (2) Subject the micro-sections to a VPN hardness check using a 5 kg load and a .2/3 rds objective at 0.020 in. (0,51 mm) increments, traversed across the microsections. Check that the heat affected zone is limited to the area shown in Figure 402 (manufactured test piece) or Figure 403 (unserviceable standard part).

4. <u>Instructions</u>

- A. Inspect
 - (1) Check the front and rear faces for distortion (Ref.Fig. 404).
- B. Remove Aluminium Paint
 - (1) Remove the aluminium paint from the spacer ring using cleaning process F. (Refer to the Overhaul Manual 72-09-00 Cleaning).
 - (2) Inspect for the satisfactory removal of the aluminium paint.

C. Machine

- (1) Locate fixture ref. tool item 1 to a centre lathe.
- (2) Locate the spacer ring to the fixture and set true to datum diameters A and B.
- (3) Machine the Labyrinth fins to 18.120 in. (460,25 mm) diameter.
- (4) Inspect for the satisfactory completion of the machining operation.



- D. Plasma Weld the Labyrinth Fins
 - (1) Build up the labyrinth fins to a minimum height of 0.080 in. (2,03 mm) using the plasma welding technique. Refer to Figure 403 and paragraph 7 for welding data.

CMT

(2) Inspect for the satisfactory completion of the welding operation.

E. Heat Treat

(1) Heat treat the spacer ring in a controlled atmosphere at 580 deg C plus/minus 5 deg C for 1 hour. Cool in air.

CMT

F. Inspect

- (1) Inspect the spacer ring for cracks using magnetic particle crack detection as detailed for this component in Chapter 72-33-02 Inspection/Check.
- G. Machine (Ref. Fig. 401)
 - (1) Locate fixture ref tool item 1 to a centre lathe.
 - (2) Locate the spacer ring to the fixture and set true to datum diameters A and B.
 - (3) Machine the Labyrinth fins to 18.2400/18.2368 in. (463,296/463,215 mm) diameter, and turn to produce the 15 deg. angles with a fin tip width of 0.010/0.005 in (0,25/0,13 mm) under the following conditions:

Tool : ISO "K" range

Speed : 50 to 100 r.p.m. and 15 r.p.m.

manual

Feed : 0.004 in. (0,10 mm) per rev.

Depth of finish: 0.002 in. (0,05 mm) maximum.

cut

Coolant : Soluble oil 60 to 1 dilution.

CMT

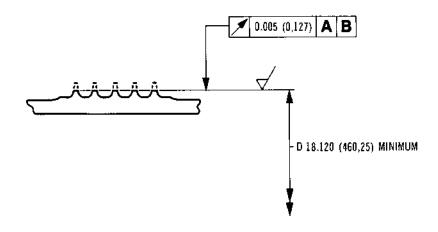
(4) Remove burrs and sharp edges.

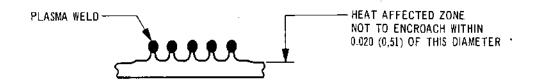
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CR 35993 /00A

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

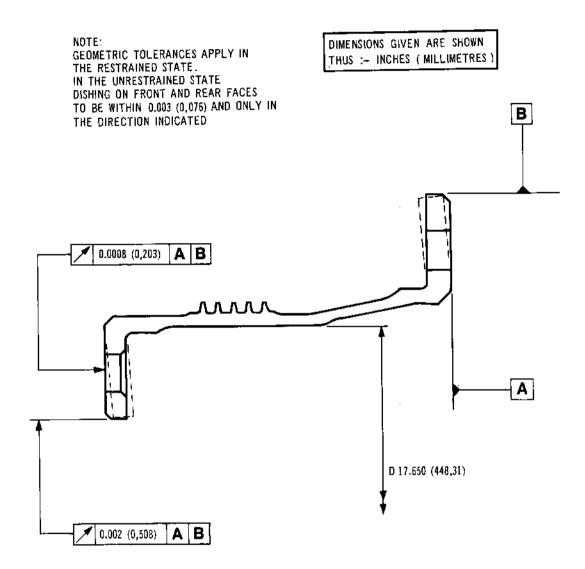




Machining and Plasma Welding Details Figure 403

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Geometric Tolerances Figure 404

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H. Inspect

- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Inspect for cracks using magnetic particle crack detection as detailed for this component in Chapter 72-33-02 Inspection/Check.

CMT

(3) Check the front and rear faces for distortion (Ref. Fig. 404).

J. Aluminium Enamel

- (1) Protect the surface of the spacer ring with high heat resisting aluminium enamel as instructed in Chapter 72-09-04 Repair.
- (2) Inspect for the satisfactory completion of the enamelling operation.

K. Identify

(1) Mark SAL B.935523 or R2O on the adjacent lobe to the existing part number. Do not mark in the scallops. Use electro-chemical marking or vibropercussion engraving (Ref.72-09-00 Repair).

L. Final Inspection

(1) Finally inspect the spacer ring to ensure that the repair has been carried out satisfactorily, and that the spacer ring is in a serviceable condition.

5. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Qty</u> | <u>Part Number</u> | <u>Item</u> |
|--------------------|------------|--------------------|-------------|
| Machining Fixture | 1 | S3S 12421000 | 1 |

Replacement Parts

None.

REPAIR

Repair No.20 Page 409 Jun 30/95



7. Welding Data

Material

MSRR 6519 FV535

Preparation

Fins machined to 18.120 in.

(460,25 mm) diameter

Weld Geometry

Circumferential

Filler Wire

MSRR 9500/5

26 swg (0.018 in. (0,46 mm diameter))

Feed Rate

52 in. (1321 mm) per minute

Machine

Union carbide 100 amp with fine wire

feed

Upslope Current

Nil

Welding Current

35-38 amps

Downslope Current

Maximum that can be set on machine

Plasma Gas

Argon 0.30 cu.ft./h at 30 psi

(0,142 l/min at 210 kPa).

Shield

5% Hydrogen, 95% Argon. 15 cu.ft/h

at 30 psi (7, l/min at 210 kPa)

Backing

Nil

Trailing

Nil

Weld Speed

6 in./min (152 mm/min)

Nozzle

No.2 orifice dia. 0.052 in. (1,32 mm)

Electrode

3/32 in. (2,38 mm) dia. thoriated

tungsten

Arc Length

0.150/0.200 in. (3,81/5,08 mm)

Polarity

Electrode negative

REPAIR 72-33-02 Repair No.20 Page 410 Jun 1/96



HP COMPRESSOR ROTOR SHAFT FRONT - REPAIR NO 1 TO 2 INTERSTAGE LABYRINTH FINS RESTORED BY PLASMA WELDING

MODIFICATION NO.OL.8837C

1. Effectivity

| I.P.C. | Fig./Item | Part No. |
|-------------------|-----------|--|
| 72 - 33-02 | 1/260A | B922639, B922640 B922905, B922906 B922907, B922908 |
| | 1/260B | B927125, B927126 B927129, B927130 |
| | | B927131, B927132 B930066, B930067 B930068, B930069 |
| | | B930070, B930071 B930072, B930073 |
| | | B930074, B930075 B930076, B930077 |
| | 1/260c | B930192, B930193 |

2. Introduction

A. General

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS

SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE

NUMBER CMT 139/B935526.

- (1) This repair describes the procedure for restoring the worn interstage labyrinth fins on the HP compressor rotor shaft front, to maintain the labyrinth/fin housing clearance. The fins are reduced in diameter, built-up by plasma welding, and machined to standard dimensions.
- (2) The operations that are subject to Component Manufacturing Technique control are indicated CMT.
- (3) A test piece shall be produced and subjected to metalurgical examination; test pieces are required initially and upon any change of airline operator, sub-contractor, machine or welding equipment.

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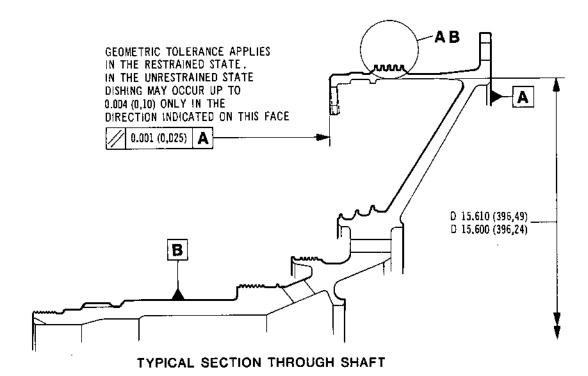
- (4) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (5) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (6) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (7) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (8) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (9) Surface texture is to be 125 micro-inches (3,2 micrometres).
- (10) All tools referred to by item number in procedural steps are detailed in para.4.
- (11) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.
- B. Repair Limitations
 - (1) Distortion of the front flange must not exceed the limits shown in Figure 4D1 prior to repair.

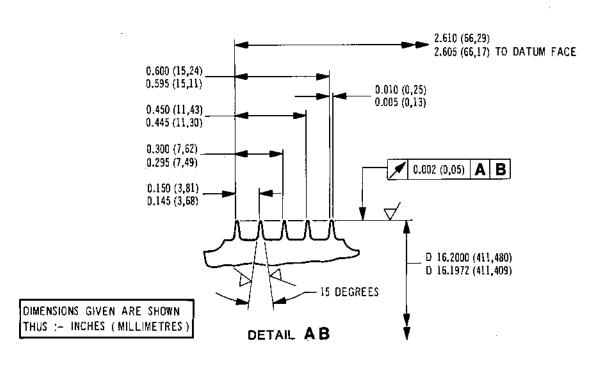
3. Test Piece

- A. Produce Test Piece.
 - (1) Produce a test piece from fully heat treated MSRR8634 to the dimensions given in Figure 402.
 - (2) It is permissible to use an unserviceable standard part as a test piece. In this case, machine the fins to 16.080 in. (408,43 mm) minimum diameter. (Ref. Fig.403).
- B. Plasma Weld Test Piece
 - (1) Build up the labyrinth fins to a minimum height of 0.080 in. (2,03 mm) using the plasma welding technique. Refer to Fig. 402, Fig. 403 and paragraph 7 for welding data.

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Standard Dimensions Figure 401

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C. Metalurgical Examination of Test Piece

NOTE: The following examination must be carried out by the controlling laboratory.

- (1) Produce four suitable micro-sections at 90 deg from the test piece weld surface.
- (2) Subject the micro-sections to a VPN hardness check using a 5 kg load and a 2/3 rds objective at 0.020 in. (0,51 mm) increments, traversed across the micro-sections. Check that the heat affected zone is limited to the area shown in Figure 402 (manufactured test piece) or Figure 403 (unserviceable standard part).

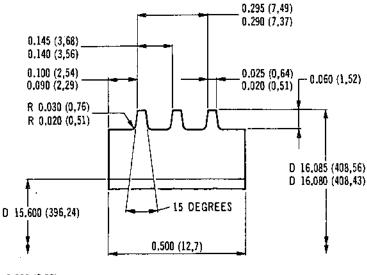
4. Instructions

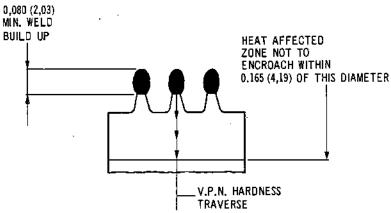
- A. Inspect
 - (1) Check the front flange for distortion (Ref. Fig. 401).
- B. Machine
 - (1) Locate fixture ref. tool item 1 in a centre lathe.
 - (2) Locate the rotor shaft front to the fixture, and set true to datum diameters A and B.
 - (3) Machine the Labyrinth fins to 16.080 in. (408,43 mm) minimum diameter (Ref.Fig.403).
 - (4) Inspect for the satisfactory completion of the machining operation.
- C. Plasma Weld the Labyrinth Fins
 - (1) Attach anti-distortion weld fixture ref. tool item 2 to the rotor shaft front.
 - (2) Build up the interstage labyrinth fins using the plasma welding technique. Refer to Figure 403 and paragraph 7 for welding data.

CMT

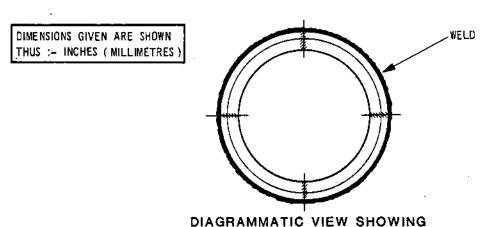
(3) Inspect for the satisfactory completion of the welding operation using checking template reftool item 3.

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MICRO-SECTION OF TEST PIECE



POSITIONS OF MICRO-SECTIONS

Test Piece Figure 402

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- D. Machine (Ref.Fig.401)
 - (1) Locate fixture ref tool item 1 to a centre lathe.
 - (2) Locate the rotor shaft front to the fixture and set true to datum diameters A and B.
 - (3) Machine the labyrinth fins to 16.2000/16.1972 in. (411,480/411,409 mm) diameter, and produce the 15 deg. angles with a fin tip width of 0.010/0.005 in. (0,25/0,13 mm) under the following conditions:

Tool

: ISO "K" range

Speed

: 57 r.p.m.

Feed

: 0.004 in. (0,10 mm) per rev.

Max. depth of

: 0.002 in. (0.05 mm)

çut

Coolant

: Soluble oil.

CMT

(4) Remove burrs and sharp edges.

E. Inspect

- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Etch the repaired areas as detailed in Chapter 72-09-14 Repair, using Solution A.

CMT

(3) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in Chapter 72-33-02 Inspection/Check.

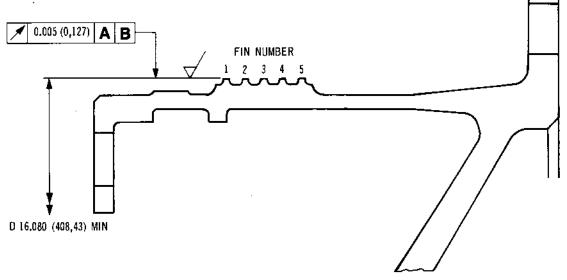
CMT

- F. Vapour Blast the Labyrinth Area
 - (1) Mask off the rotor shaft front with suitable waterproof masking tape; ensure that only the repair area is exposed.
 - (2) Vapour blast the labyrinth area using the technique specified in Chapter 72-09-13 Repair, procedure B. Remove the masking tape.

CMT

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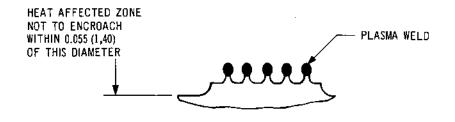
DIMENSIONS GIVEN ARE SHOWN
THUS :- INCHES (MILLIMETRES)



IF REQUIRED

| LAYER | FIN No 1 | 2 | 3 | 4 | 5 | COMMENTS |
|------------|----------|----|----|----|----|--------------|
| 1 | 36 | 40 | 40 | 40 | 36 | WITHOUT WIRE |
| 2 | 33 | 36 | 36 | 36 | 33 | WITH WIRE |
| 3 | 33 | 36 | 36 | 36 | 33 | WITH WIRE |
| 4 | 33 | 36 | 36 | 36 | 33 | WITH WIRE |
| 5 | 33 | 36 | 36 | 36 | 33 | WITH WIRE |
| * 6 | 33 | 36 | 36 | 36 | 33 | WITH WIRE |

CURRENT SETTINGS (AMPS)



Plasma Welding Details Figure 403

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G. Identify

(1) Mark SAL B935526 or R21 adjacent to the existing part number, using electro-chemical marking (Ref Chapter 72-09-00 Repair).

H. Final Inspection

(1) Finally inspect the rotor shaft front to ensure that the repair has been carried out satisfactorily and that it is in a serviceable condition.

5. Special Tools, Fixture and Equipment

| <u>Description</u> | <u>Qty</u> | <u>Part Number</u> | <u>Item</u> |
|--------------------|------------|--------------------|-------------|
| Machining Fixture | 1 | s3s 15507000 | 1 |
| Welding Fixture | 1 | \$3\$ 14406000 | 2 |
| Template | 1 | s3s 14405000 | 3 |

6. Replacement Parts

None.

7. Welding Data

| Material | Titanium MSRR 8634 |
|-------------------|---|
| Preparation | Machined surface |
| Weld Geometry | Circumferential |
| Filler Wire | MSRR 9500/70 26 swg (0.018 in. (0,46 mm diameter)) |
| Feed Rate | 40 in. (1016 mm) per minute |
| Machine | Union carbide 100 amp with fine wire feed |
| Upslope Current | Machine Standard |
| Welding Current | See Fig.403 |
| Downslope Current | Machine Standard |



Plasma Gas Argon 0.40 cu.ft./h at 30 psi

(0,189 l/min at 210 kPa)

Shield 5% Hydrogen, 95% Argon. 15 cu.ft/h

at 30 psi (8 l/min at 210 kPa)

Backing Nil

Trailing Argon 20 cu.ft./h at 30 psi

(9,44 l/min at 210 kPa)

Weld Speed 6 in./min (152 mm/min)

Nozzle No.2 orifice dia. 0.052 in. (1,32 mm)

Electrode 3/32 in. (2,38 mm) dia. thoriated

tungsten

Arc Length 0.150/0.200 in. (3,81/5,08 mm)

Angle of Gun Vertical

Polarity Positive earth



<u>HP COMPRESSOR DRIVE SHAFT - REPAIR AIR TRANSFER TUBE</u> LOCATION RESTORED WITH A COBALT/CHROME CARBIDE COATING

MODIFICATION NO.OL.8875C

1. Effectivity

| I.P.C. | <u> Fig</u> | ./Item | <u>Part No.</u> | |
|----------|-------------|--------------|--|--|
| 72-33-02 | 3 | 330A 3308 | B.923990 B.925461 B.935451 B.935454 | B.923991 B.925462 B.935452 B.935455 |

Introduction

A. General.

CAUTION:

COMPLIANCE WITH ALL ASPECTS OF THIS REPAIR PROCESS SHOULD BE ACHIEVED WITHOUT DEVIATION. WHERE A NEED TO DEVIATE IS CONSIDERED NECESSARY, REFERENCE SHOULD BE MADE TO THE REPAIR AUTHORITY FOR AGREEMENT.

- (1) This repair describes the procedure for restoring the air transfer tube location on the HP compressor drive shaft by coating with cobalt/chrome carbide and machining to the standard dimensions.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.

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MK.610-14-28 snecma OVERHAUL

- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. <u>Instructions</u>

- A. Machine Locating Spigot
 - (1) Locate the HP compressor drive shaft to a jig boring machine or a vertical lathe, and clamp using suitable support blocks. Set true to datums B and C (Ref.Fig.401).
 - (2) Machine the air transfer tube location spigot, removing the minimum amount of material necessary to clean up. Small areas up to 0.2 in. (5 mm) along the circumference which have not cleaned up but are crack free when hand blended, are acceptable. The minimum allowable diameter is 11.960 in. (303,78 mm) (Ref.Fig.401). Record the machined diameter.

NOTE: For repeated repairs, completely remove all traces of existing coating by chemical stripping to TSD 594 OP 354.

- (3) Remove burrs and sharp edges.
- B. Inspect.
 - (1) Inspect for the satisfactory completion of the machining operation.
 - (2) Inspect for cracks using the fluorescent dye pentrant process detailed for this component in Chapter 72-33-02 Inspection/Check.

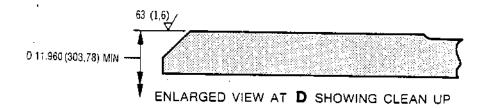
CR 36053/00C

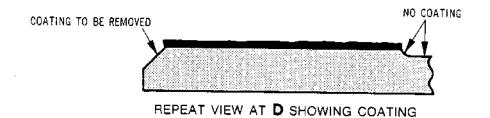
DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

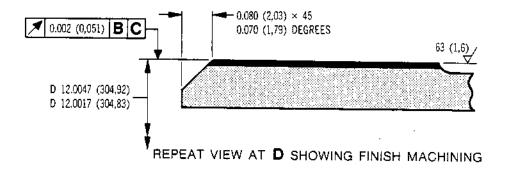
SURFACE ROUGHNESS VALUES ARE SHOWN THUS: - MICRO-INCHES (MICROMETRES)

[D 18.157 (461,19)]

[D 18.155 (461,14)]







Spigot Machining and Coating Details Figure 401

REPAIR

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C. Apply Coating

(1) Despatch the HP drive shaft to BAJ Limited for the application of Cobalt/Chromium Carbide wear resistant coating (Tribomet T104C) to the air transfer tube location spigot.

The coating applied is to be of sufficient depth to allow a diameter of 12.005 in. (304,93 mm) to be achieved after final machining. Work to process RPS 526.

Sub-contractor's address:

BAJ Ltd., Banwell, Weston-super-Mare,
Avon, BS24 8PD.

(2) On receipt of the shaft from BAJ Ltd., inspect for the satisfactory application of the Tribomet coating (Ref. overhaul process TSD594-354).

D. Machine Coating

(1) Locate the HP compressor drive shaft to a jig boring machine or a vertical lathe, and clamp using suitable support blocks. Set true to datums B and C (Ref.Fig.401).

(2) Finish machine the Tribomet coating to the dimensions given in Figure 401. Observe the following conditions:

Tool : Single point (to be kept sharp)

Tool material : Tungsten carbide (G5 type)

Manufacturing method : Turning

Speed : 16 rev/min

Feed : 0.003 in. (0,08 mm) per rev.
Depth of cut : 0.005 in. (0,13 mm) max.

Finish cut approx. 0.003 in.

(0.08 mm)

Coolant : General purpose microfine

concentrate type CSS127

30 to 1 mix.

E. Inspect.

(1) Inspect for the satisfactory completion of the machining operation.

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- F. Identify
 - (1) Mark SAL B.506054 or R22 and coating identity symbol (C) adjacent to the existing part number, using electro-chemical marking or vibro-percussion engraving as specified in Chapter 72-09-00 Repair.
- G. Final Inspection
 - (1) Finally inspect the HP compressor drive shaft to ensure that the repair has been carried out satisfactorily, and that the shaft is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.



HP COMPRESSOR DRIVE SHAFT - LABYRINTHS NO'S. 13, 14 AND 15 RESTORED BY TIG WELDING

MODIFICATION NO. 01.8894C

Effectivity

| I.P.C. | <u>Fig./</u> | <u>Item</u> | <u>Part Number</u> | |
|----------|--------------|-------------|--------------------|---|
| 72-33-02 | 3 | 330B | В925461, | B923991, B925462, B935452, B935455 |
| | 3 | 330c | в935457, | в935458 |

2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 140/8488639-41.

(1) This repair describes the procedure for restoring the labyrinths number 13, 14 and 15 by mechanised TIG welding, and machining to the standard dimensions.

CAUTION: IF REPAIR INSTRUCTION 8476039 (R17) HAS BEEN APPLIED TO THE COMPONENT BEING WORKED, THEN THE COATING MUST BE REMOVED PRIOR TO HEAT TREATMENT AND RE-APPLIED AFTER WITH REFERENCE TO 8476039.

- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) The operations that are subject to Component Manufacturing Technique control are indicated CMT.

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- (5) A test piece shall be produced and subjected to metallurgical examination; test pieces are required initially and upon any subsequent change of airline operator, sub-contractor, machine or locallity. Test pieces are also required after every ten component repairs or annually, where time elapsed between component repairs exceeds one year.
- (6) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (7) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (8) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (9) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.
- (1D) All tools referred to by item number in procedural steps are detailed in para.5.
- (11) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. Test Piece

- A. Produce Test Piece.
 - (1) Produce a test piece from fully heat-treated MSRR.7084 material to the dimensions given in Figure 401. It is permissible to use an unserviceable standard part as a test piece. In this case, machine the labyrinth fins to the dimensions given in Figure 403.
 - (2) Remove the sharp edges from the fin.
 - (3) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.

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B. Weld Test Piece.

- (1) Build up the single fin to a minimum height of 0.075 in. (1,91 mm) as indicated in Figure 401 by mechanised TIG welding using filler rods 0Mat 3/99 as instructed in TSD 594 0P 409. For welding data, refer to paragraph 7.
- (2) Build up the blanket weld with a single weld run only, as indicated in Figure 401 by mechanised TIG welding using filler rods OMat 3/99 as instructed in TSD 594 OP 409. For welding data, refer to paragraph 7.

C. Machine.

(1) Locate the test piece in a lathe and machine the blanket weld only, removing the minimum material, until the surface is free of defects, e.g. voids, porosity, etc.

D. Inspect.

(1) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.

E. Weld.

(1) Repeat operations in paragraphs 3B(2) to 3D until the minimum build-up is achieved (Ref. Fig. 401).

F. Heat Treat.

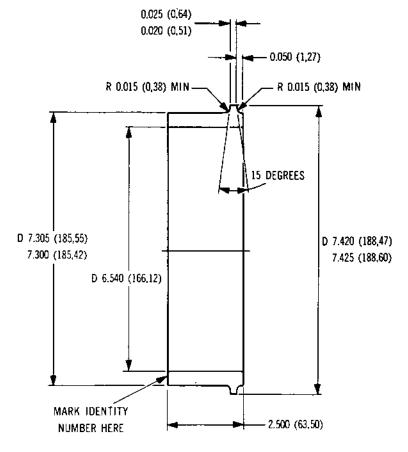
(1) Heat treat the test piece in an argon gas atmosphere at 760 deg.C. plus/minus 10 deg.C. for 16 hours. Cool in air.

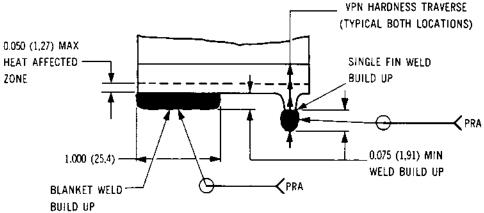
G. Identify.

(1) Mark B497473 on the test piece using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.

H. Inspect.

(1) Inspect the blanket weld only, using the ultrasonic C-scan process as specified in Chapter 72-09-00 Inspection/Check.





DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Test Piece Details Figure 401

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J. Metallurgical Examination.

NOTE: The following examination must be carried out by the controlling laboratory.

- (1) Produce four suitable micro-sections at 90 deg. from the test piece surface.
- (2) Subject the micro-sections to a VPN hardness check using a 5 kg load and a 2/3rds objective at 0.020 in. (0,51 mm) increments, traversed across the micro-sections. Check that the heat affected zone is limited to the area shown in Figure 401 (test piece) or Figure 406 (unserviceable standard part).

Instructions.

A. Machine.

- (1) Locate the HP drive shaft on a centre-lathe, with the large flange secured to a faceplate and the small end located by a running centre. Set true to datums (Ref.Fig.402).
- (2) Machine the seal fins of the No's.13, 14 and 15 labyrinths to the dimensions given in Figure 403.
- (3) Remove burrs and sharp edges.

B. Inspect.

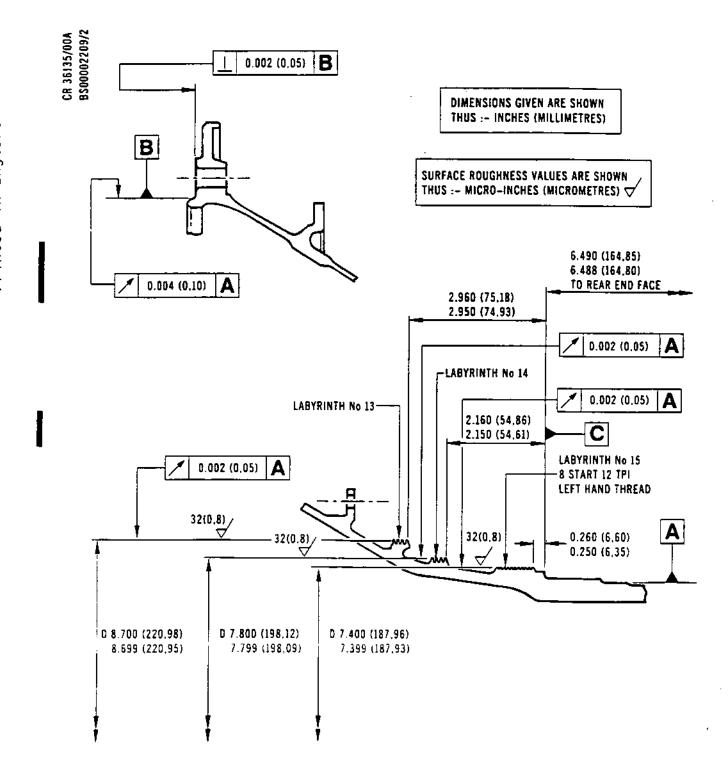
- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in Chapter 72-33-02 Inspection/Check.

CMT

(3) Measure and record the position of the fins on labyrinths No's.13 and 14 (Ref.Fig. 404).

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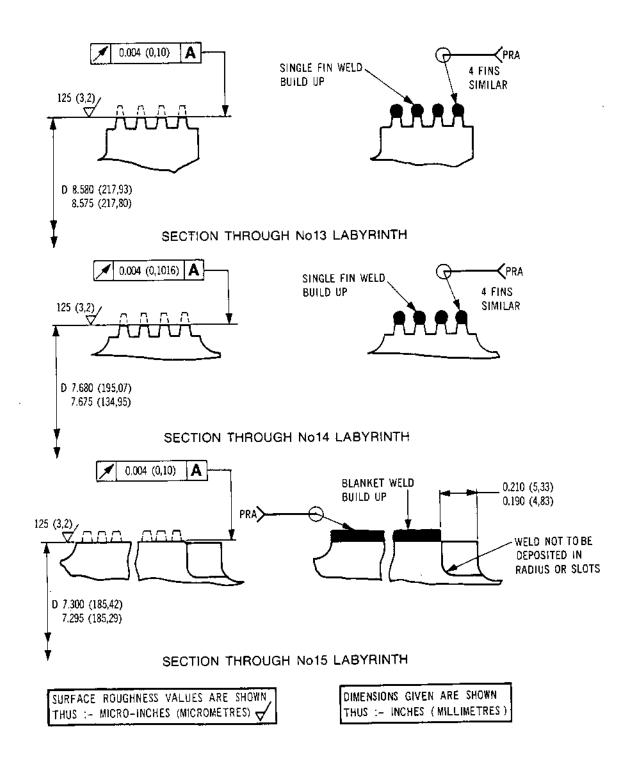


Standard Dimensions Figure 402

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8

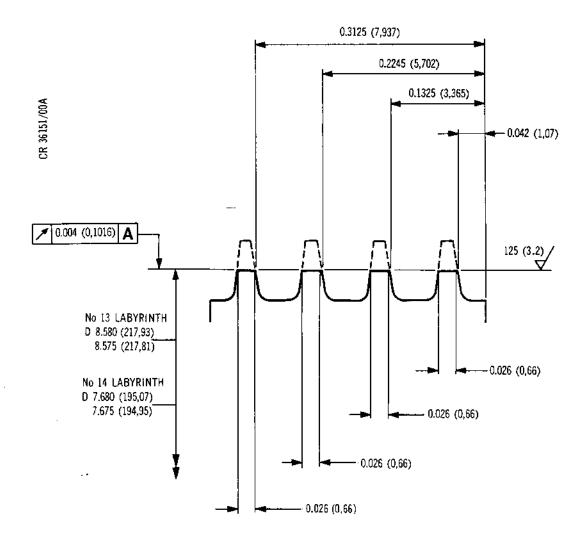




Machining and Welding Details Figure 403

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TYPICAL SECTION THROUGH No13 OR No14 LABYRINTHS

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Reference Dimensions Figure 404

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c. Weld.

(1) Build up the fins of the No's.13 and 14 labyrinths as indicated in Figure 403, by mechanised TIG welding using filler rods OMat 3/99 as instructed in TSD 594 OP 409. Weld build-up must be sufficient to allow finish dimensions to be achieved (Ref.Fig.402 and 405). For welding data, refer to paragraph 7.

(2) Build up the No.15 labyrinth location as indicated in Figure 403, by a single weld run only, using mechanised TIG welding with filler rods OMat 3/99 as instructed in TSD 594 OP 409. For welding data, refer to paragraph 7.

CMT

D. Machine.

- (1) Locate the shaft on a centre-lathe with the large flange secured to a faceplate and the small end located by a running centre. Set true to datums (Ref.Fig.402).
- (2) Machine the No.15 labyrinth seal location, removing the minimum material, until the surface is free of all defects, e.g. voids, porosity etc.

E. Weld.

(1) Repeat the welding, machining and inspection operations for labyrinth No.15 only as instructed in paragraphs 4C(2), 4D and 4E, until sufficient material is built up to achieve the finish dimensions (Ref.Fig.402 and 405).

F. Inspect.

- (1) Inspect shaft for distortion (Ref.Fig.402).
- (2) Inspect weld (Ref.TSD 594 Op.409).

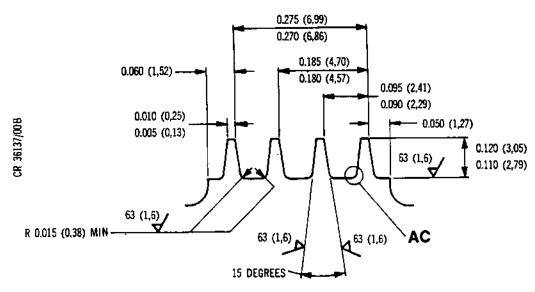
CMT

- (3) Inspect the No's.13, 14 and 15 seal locations using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02, Inspection/Check. CMT
- (4) Inspect the No.15 labyrinth location using the ultrasonic C-scan process, as specified in Chapter 72-09-00 Inspection/Check.

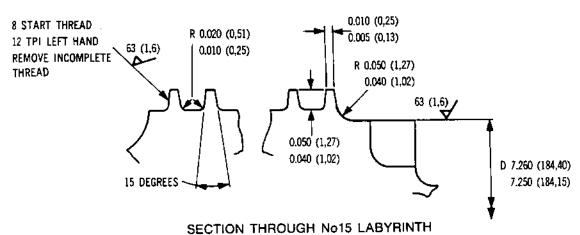
CMT

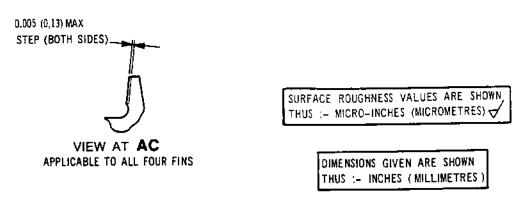
REPAIR

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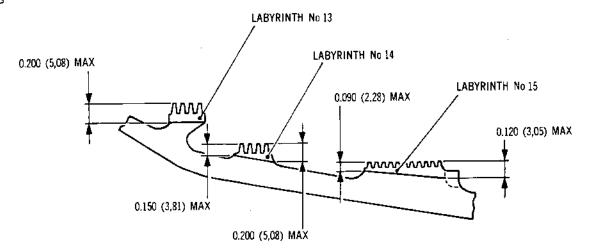
SECTION THROUGH No13 AND No14 LABYRINTH





Labyrinth Machining Details Figure 405

REPAIR **72-33-02** Repair No.23 Page 410 Jan 31/94 CR 36138/00A



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Heat Affected Zones Figure 406



G. Machine.

- (1) Locate the shaft on a centre-lathe with the large flange secured to a faceplate and the small end located by a running centre. Set true to datums (Ref.Fig.402).
- (2) Finish machine the fins of No's.13 and 14 labyrinths using form tool ref. tool item 1, to the dimensions given in Figure 405. Use the dimensions previously recorded (para.48(3)) to ensure that the maximum step is 0.005 in. (0,13 mm) (Ref.Fig.405 view AC).
- (3) Finish machine the No.15 labyrinth (windback seal) using form tool ref. tool item 2, to the dimensions given in Figures 402 and 405.
 CMT
- (4) Inspect Datum face C for evidence of weld/machining CUSP. If evident, skim grind flush to existing surface ensuring 6.490 (164,85) max dimension from rear end face is maintained (ref.Fig.402).
- H. Heat Treat. (Refer to Section 2.A (1) CAUTION)
 - (1) Heat treat the shaft in an inert gas or vacuum furnace at 760 deg.C plus/minus 10 deg.C for 16 hours. Rapid gas quench.
 CMT

K. Inspect.

- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Inspect shaft for distortion (Ref. Fig. 402).
- (3) Chemically etch the repaired areas as instructed in Chapter 72-09-14 Repair, using Solution C.

(4) Inspect the shaft using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02 Inspection/Check.

CMT

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L. Vapour Blast.

- (1) Mask off the shaft with suitable waterproof masking tape. Ensure that only the repair area is exposed.
- (2) Vapour blast the labyrinth fins as instructed in Chapter 72-09-13 Repair, using 320/400 mesh aluminium oxide grit at Almen 2N intensity.

CMT

M. Identify.

(1) Mark the appropriate salvage number (Ref. Table 401) adjacent to the existing part number, using electrochemical or vibro-percussion marking as specified in Chapter 72-09-00 Repair.

| SALVAGE NO. | LABYRINTH NO. | TEST PIECE | |
|-------------|---------------|------------|--|
| B488639 | 13 | B497463 | |
| B488640 | 14 | B497473 | |
| В488641 | 15 | B497473 | |

Table 401

N. Final Inspection.

(1) Finally inspect the shaft to ensure that the repair has been carried out satisfactorily and that the shaft is in a serviceable condition.

5. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | Part No. | <u>Įtem</u> | |
|--------------------|-----------------|----------------|-------------|--|
| Form tool | 1 | \$3\$.15511000 | 1 | |
| Form tool | | \$3\$.15510000 | 2 | |

6. Replacement Parts

None.



7. Welding Machine Data

A. Labyrinth No.13 and 14 Fins.

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991.5 l/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 7.3

Deadband : 4

Sensitivity : 2

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 37 Amps

Weld Mode : Pendant Setting 37 Amps

Filler Material Spec. : OMat 3/99

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MK.610-14-28 snecma

Size : 0.030 in. (0,76 mm) dia.

Feed Rate : 6.0 IPM (152.4 mm/min.)

Filler Wire Start Delay : 0.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 260

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 60

Weld Mode : 60 Increasing to 100 as Fin

Height Progresses

NOTE: All reading shown are machined dial readings unless

otherwise indicated.

COMMENTS: Set table at 90°, wire brush after each weld

deposit.

B. Labyrinth No.15 (Blanket Weld)

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : HY-PLAS

Gas Flow Rate : 35 CFH (991.5 l/h)

Trailing Gas :

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OVERHAUL

Gas Flow Rate :

9.0 Voltage (AVC)

Deadband

3 Sensitivity

Lock Out No

0 Retract Distance

0.04 Starting Arc Gap

Start Delay 2.7

Welding Current

Fusion Mode Pendant Setting 35 Amps

Weld Mode Pendant Setting 35 Amps

Filler Material Spec. : OMat 3/99

Size 0.030 in. (0,76 mm) dia.

6.5 IPM (165 mm/min.) Feed Rate

Filler Wire Start Delay 0.3

Filler Wire Stop Delay 0.1

Dabber Strokes/Min 305

Stroke Length 0.470 in. (12 mm)

Pulsation Nο

Weld Speed

Fusion Mode 30

Weld Mode 30

All readings shown are machine dial readings unless NOTE:

otherwise indicated.

Set table at 80°, wire brush after each weld COMMENTS:

deposit.

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DISK, COMP, ROTOR H.P. STAGE 2

REMOVAL OF CORROSION AND DAMAGE BY BLENDING AND MACHINING. (POST_MOD.8896 STD)

B511542

1. EFFECTIVITY

| <u>IPC</u> | <u>Fiq</u> | ./Item | Part No. | Part No. | |
|------------|------------|--------|-------------------------------|-------------------------------|--|
| 72-33-02 | 1 | 3000 | 8509592 8512723 8512725 | B509593 B512724 B512726 | |
| | 1 | 300E | 8512567 8512740 8512742 | B512570 B512741 B512743 | |
| | 1 | 300 F | 8516997 8516999 8517001 | 8516998 8517000 8517002 | |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Geometric tolerances and dimensions apply in the restrained state.

Hand blending/polishing and/or machining may be carried out as applicable to remove corrosion pitting and damage within the following zones:- A, B, C, D and E. (See Fig. 401).

Zones A and D. Maximum blend depth:- 0.010(0,25)

Removal of corrosion pitting or damage within 0.080 (2,03) of serrations (Zones A and D) by hand blending / polishing is not permissible.

Zones B and E. Maximum blend depth: - 0.002(0,05) (Applicable to face only)

80% of Zones B and E must be unaffected by corrosion pitting or damage.

REPAIR 72-33-02 Repair No. 24 Page 401 Jun 1/96 Removal of corrosion pitting or damage within 0.250(6,35) of bolt hole (Zones B and E) by hand blending/polishing is not permissible.(See Fig.404).

Corrosion pitting or damage within Zone 8 in excess of 0.002 (0,05) depth or exceeding the 80% limit may be removed by machining defective face within dimension shown. (See Fig. 403). Any remaining corrosion or damage may be removed by hand blending/polishing within Repair Limitations.

Zone C.

Maximum blend depth: - 0.003(0,08)

If excess corrosion pitting or damage is apparent in this zone, remove by working to 72-33-02 Repair No 10. Any corrosion pitting or damage remaining may be removed by hand blending/polishing within Repair Limitations as follows:

MINOR DAMAGE.

Maximum blend depth:- 0.003 (0,08)

Any number of bolt holes may be affected and at any position within the hole.

MAJOR DAMAGE. (BOLT HOLE IS SPLIT INTO 4 CLOCK POSITIONS REFER TO FIG. 408).

10 o'clock to 2 o'clock and 4 o'clock to 8 o'clock positions

Maximum blend depth:- 0.007 (0,18)

8 o'clock to 10 o'clock and 2 o'clock to 4 o'clock positions Maximum blend depth:- 0.010 (0,25)

A maximum 10 off bolt holes may be affected by major damage.

Major damage is not permissible in adjacent bolt holes.

Major damage is not applicable to bolt hole chamfers.

NOTE:

Corrosion pitting is to be removed to twice its depth to ensure complete removal.

For re-application of Repair Instruction, a total blend depth shall not exceed the limits quoted in Repair Limitations.

REPAIR

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GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63(1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

<u>CAUTION:</u> During repair of this component, surfaces must be protected from corrosion at all times. Work to procedure detailed in Overhaul Manual Chapter 72-09-20 Repair using dewatering oil.

1) Remove protective coating.

Refer Overhaul Manual Chapter 72-09-00 Cleaning using Process F.

Descale to remove all corrosion products.

Refer Overhaul Manual Chapter 72-09-00 Cleaning using Process L.

3) Hand blend the damaged/ corroded areas. Blends to be smooth and continuous with no sharp edges or corners. Refer Repair Limitations. Refer Fig. 401. Use conventional hand tools. Refer Overhaul Manual. Chapter 72-09-22 Repair.

4) Hand polish blended areas to achieve a surface finish of 63 microinches (1,6 micrometers).

For repaired areas in Zone C only, proceed with operations 5, 6 and 7.

5) Locally swab etch repaired areas.

Refer Overhaul Manual Chapter 72-09-14 Repair. Use Solution D.

6) Locally penetrant inspect repaired areas.

Refer to TSD 594-J TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002 Use OMat 652

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7) Locally vapour blast using 300/500 mesh grit, 2N minimum almen intensity and 200% coverage to remove the effects of etchant. Refer Overhaul Manual Chapter 72-09-13 Repair.

8) For corrosion pitting in excess of 0.002(0,05) or exceeding the 80% limit (Zone B only) it is permissible to skim turn the face to remove majority of pitting.
Plucking or scuffing of surface is not acceptable.
NOTE: Leave a minimum 0.002(0,05) tolerance for for finish machining.

Refer Figs. 401, 402, 403 and 404.

9) Finish grind defective/machined face.
Alternatively: Face may be finish turned. Care to be taken to avoid tool chatter due to intermittent cuts.

Refer para 6 DATA.

10) Dimensionally inspect the chamfer at the 24 bolt hole positions (Zone B side only).

Refer Fig. 403.

11) If required, chamfer the 24 bolt holes.

Refer Fig. 403.

12) Any remaining corrosion pitting or damage in Zone B may be removed by hand blending. Blends to be smooth and continuous with no sharp edges or corners.

Refer Repair Limitations. Refer Fig. 401. Use conventional hand tools. Refer Overhaul Manual Chapter 72-09-22 Repair.

- 13) Hand polish blended areas to achieve a surface finish of 63 microinches (1,6 micrometers).
- 14) Visually inspect for removal of corrosion pitting and damage.
- 15) Inspect disk using the magnetic particle crack detection method.

Refer to TSD 594-J TASK 70-00-00-200-201.

16) Vapour blast repaired areas (not Zone C).

Refer Overhaul Manual Chapter 72-09-13 Repair. Use Procedure B.

17) Mark Repair Instruction number RI B511542 or R24 on component, adjacent to existing part number, using the vibro-percussion engraving technique. Markings must not be closer than 0.030(0,75) to the blade slots.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.404.

NOTE: At this point Mod.72-9020 must be effected to post Mod.72-8925 components and to post Mod. 72-8896 components if required. Re-part number accordingly. If Mod.9020 is not effected to post Mod.72-8896 components, complete repair with operations 15 to 18. For post Mod. 72-9020 components, complete repair with operations 19 to 23.

18) Derust to remove all corrosion products.

NOTE: This procedure to be completed not more than 24 hours prior to painting.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use Process H.

19) Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots and hatched areas marked AD.

NOTE: Identity markings to remain visible after application of coating.

Refer TSD 594 OP.349 using Omat 7/46 (Type A, stoved at 515 deg.C or Type B coating).
Refer Figs.405 and 406.

20) Apply corrosion resistant seal coating on top of the corrosion resistant coating. Refer TSD 594 OP.349 using Omat 7/168

NOTE: Areas AE are "brush touched up" on assembly. (Refer to Fig. 405)

21) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.

> REPAIR 33-02



FOR POST MOD.72-9020 COMPONENTS ONLY.

22) Derust to remove all corrosion products.

NOTE: This procedure to be completed not more than 24 hours prior to painting.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use Process H.

23) Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots (over areas marked AG) and hatched areas marked AD.

NOTE: Identity markings to remain visible after application of coating.

Refer TSD 594 OP.349 using Omat 7/46 (Type A, stoved at 515 deg.C or Type B coating).
Refer Figs.405, 406 and 407.

24) Apply corrosion resistant seal coating on top of the corrosion resistant coating. Refer TSD 594 OP.349 using Omat 7/168

NOTE: Areas AE are "brush touched up" on assembly. (Refer to Fig. 405)

25) Inspect fir tree root to blade clearance.

Use blade root gauge or master top limit blade. Refer para 7. TOOLS item 1.

- 26) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.
 - MATERIAL

<u>COMPONENT</u>

MATERIAL

RR CODE

DISK, COMP. ROTOR, H.P. STAGE 2. FV 535 MSRR 6519 **EBH**

- 6. DATA
 - (A) GRINDING DATA.

WHEEL TYPE: WHEEL SPEED: COMPONENT SPEED: MAX DEPTH OF CUT: COOLANT TYPE: 38 A60K VBE. 1200 r.p.m. 12 r.p.m. <u>+</u> 20%. 0.0002(0,005) per rev. CNS 30 or CSS 130.

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TURNING DATA. (B)

MACHINE:

VERTICAL LATHE

TOOL: FEED:

SINGLE POINT TUNGSTEN CARBIDE

0.006 (0,15) PER REV

COMPONENT SPEED:

COOLANT TYPE:

14 r.p.m.

CNS 30 or CSS 130.

7. T00LS

TOOL NUMBER

<u>DESCRIPTION</u>

<u>ITEM</u>

S3S14926000

GAUGE

1

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

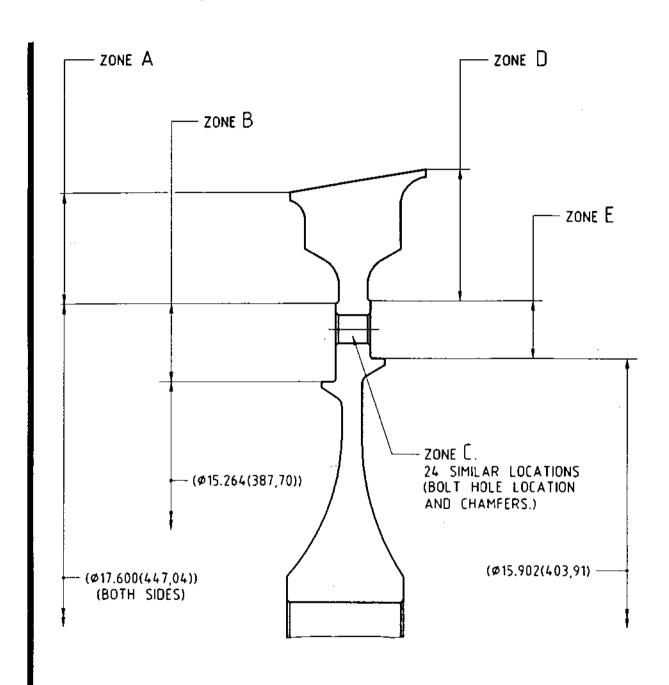
QUANTITY

<u>ITEM</u>

NONE.



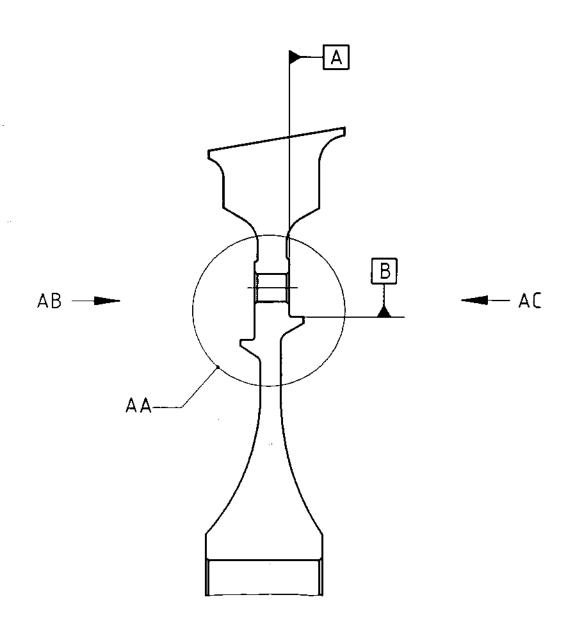
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TYPICAL SECTION THROUGH DISK FIG.401

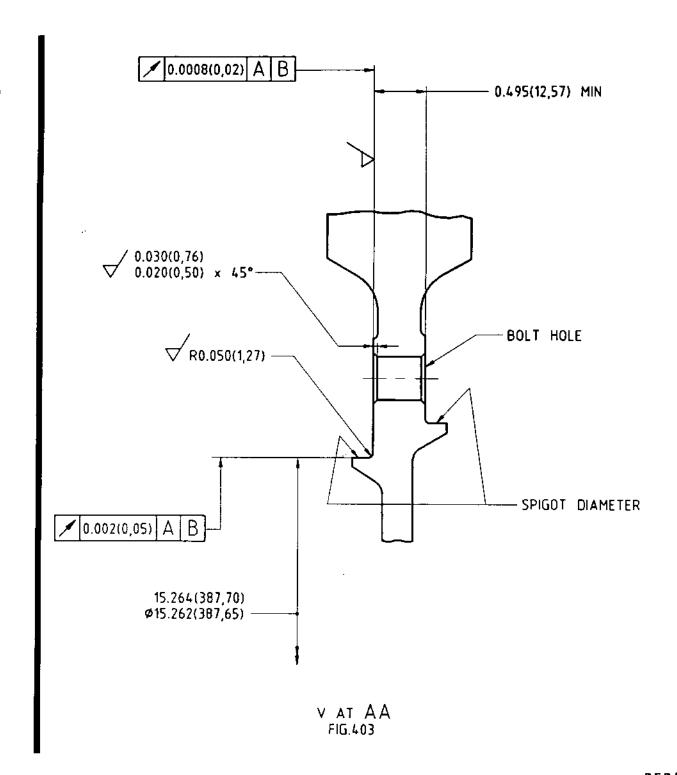
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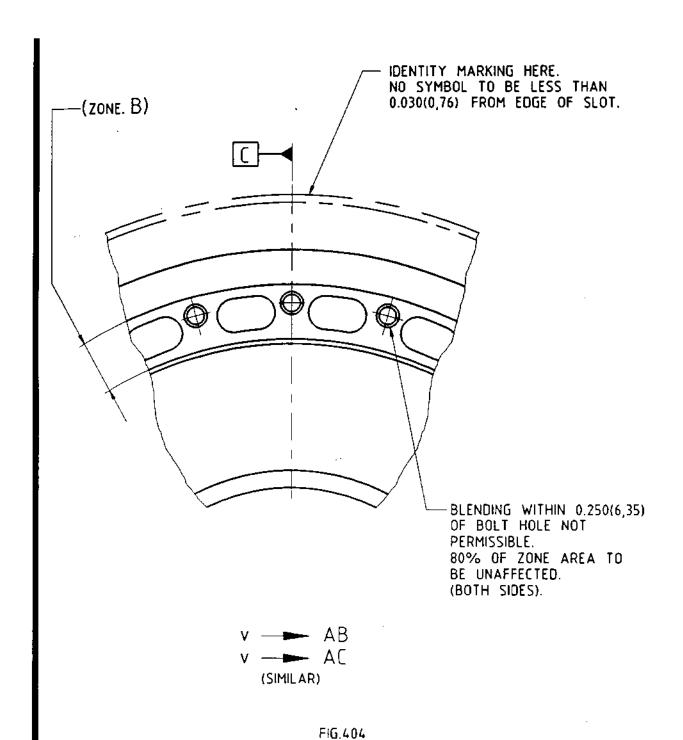


TYPICAL SECTION THROUGH DISK FIG.402

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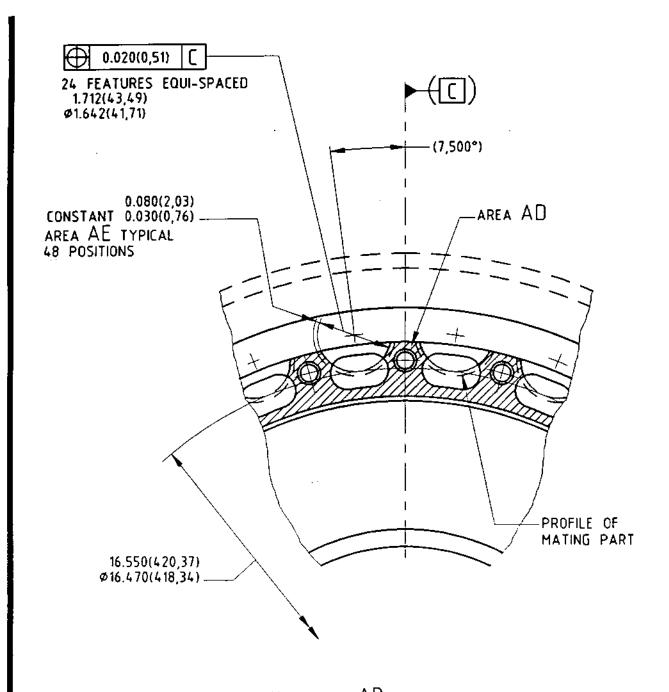


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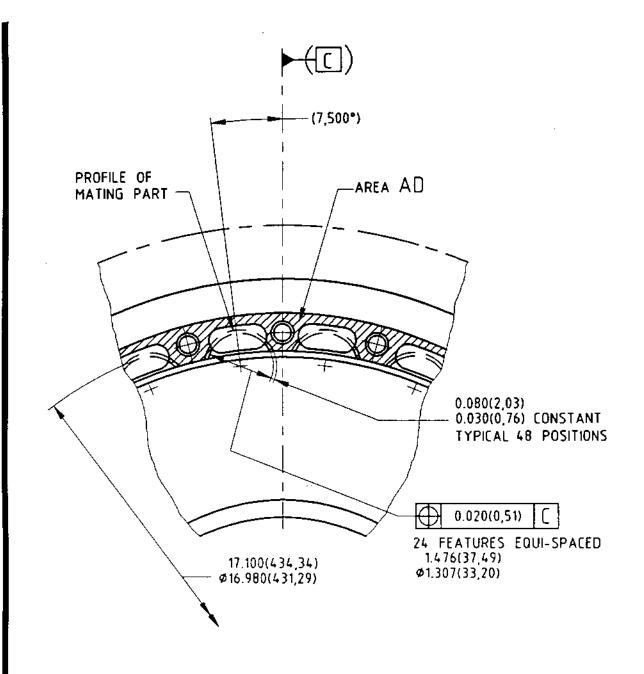


V — AB
SHOWING AREA OF PROTECTIVE COATING

FIG.405

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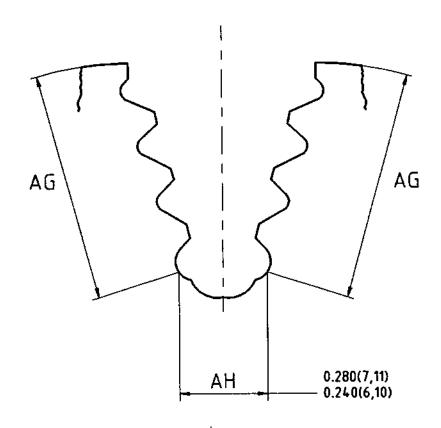


REPEAT V — AC

SHOWING AREA OF PROTECTIVE COATING

FIG.406

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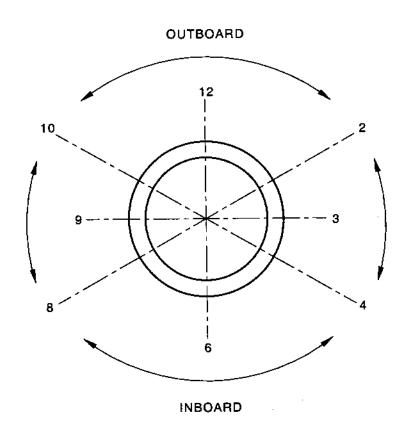


NOTE: AREA AH TO COVER TOTAL LENGTH OF SLOT.

NO OVERSPRAY IS PERMITTED ON THE
FIR-TREE SLOT AREAS MARKED AG PROTECTIVE
COATING MAY BE BRUSH APPLIED PROVIDED THAT
EVEN COVERAGE AND 'WETTING' IS OBTAINED.

TYPICAL VIEW ON FIR TREE ROOT SLOT SHOWING AREA OF PROTECTIVE COATING FIG.407.





REPEAT VIEW AB (SHOWING BOLT HOLE CLOCK POSITIONS ONLY)

FIG. 408

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DISK, COMP, ROTOR H.P. STAGE 3

REMOVAL OF CORROSION AND DAMAGE BY BLENDING AND MACHINING. (POST MOD.8896 STD)

B511719

1. EFFECTIVITY

| IPC | Fig. | <u>/Item</u> | Part No. | |
|----------|------|--------------|---|---|
| 72-33-02 | 1 | 350D | B509596 B512730 B512732 B512734 B512736 | 8509597 8512731 8512733 8512735 8512737 |
| | 1 | 350E | B512568 B512746 B512748 B512750 B512752 | 8512571 8512747 8512749 8512751 8512753 |
| | 1 | 350F | 8517003 8517005 8517007 8517009 8517011 | B517004 B517006 B517008 B517010 B517012 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Geometric tolerances and dimensions apply in the restrained state.

Hand blending/polishing and/or machining may be carried out as applicable to remove corrosion pitting and damage within the following zones:- A, B, C, D and E. (See Fig. 401).

Zones A and D.

Maximum blend depth:- 0.010(0,25)

Removal of corrosion pitting or damage within 0.080 (2,03) of serrations (Zones A and D) by hand blending / polishing is not permissible.

REPAIR 72-33-02 Repair No. 25 Page 401 Jun 1/96 Zones B and E. Maximum blend depth:- 0.002(0,05) (Applicable to face only)

80% of Zones B and E must be unaffected by corrosion pitting or damage.

Removal of corrosion pitting or damage within 0.250(6,35) of bolt hole (Zones B and E) by hand blending/polishing is not permissible.(See Fig. 404).

Corrosion pitting or damage within Zone B in excess of 0.002 (0,05) depth or exceeding the 80% limit may be removed by machining defective face within dimension shown. (See Fig. 403). Any remaining corrosion or damage may be removed by hand blending/polishing within Repair Limitations.

Zone C. Maximum blend depth: - 0.003(0,08)

If excess corrosion pitting or damage is apparent in this zone, remove by working to 72-33-02 Repair No 11. Any corrosion pitting or damage remaining may be removed by hand blending/polishing within Repair Limitations as follows:

MINOR DAMAGE.

Maximum blend depth: - 0.003 (0,08)

Any number of bolt holes may be affected and at any position within the hole.

MAJOR DAMAGE. (BOLT HOLE IS SPLIT INTO 4 CLOCK POSITIONS REFER TO FIG. 409).

10 o'clock to 2 o'clock and 4 o'clock to 8 o'clock positions Maximum blend depth:- 0.007 (0,18)

8 o'clock to 10 o'clock and 2 o'clock to 4 o'clock positions Maximum blend depth:- 0.010 (0,25)

A maximum 10 off bolt holes may be affected by major damage.

Major damage is not permissible in adjacent bolt holes.

Major damage is not applicable to bolt hole chamfers.

NOTE:

Corrosion pitting is to be removed to twice its depth to ensure complete removal.

For re-application of Repair Instruction, a total blend depth shall not exceed the limits quoted in Repair Limitations.

REPAIR

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63(1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

<u>CAUTION:</u> During repair of this component, surfaces must be protected from corrosion at all times. Work to procedure detailed in Overhaul Manual Chapter 72-09-20 Repair using dewatering oil.

1) Remove protective coating.

Refer Overhaul Manual Chapter 72-09-00 Cleaning using Process F.

Descale to remove all corrosion products.

Refer Overhaul Manual Chapter 72-09-00 Cleaning using Process L.

3) Hand blend the damaged/ corroded areas. Blends to be smooth and continuous with no sharp edges or corners. Refer Repair Limitations. Refer Fig.401. Use conventional hand tools. Refer Overhaul Manual Chapter 72-09-22 Repair.

4) Hand polish blended areas to achieve a surface finish of 63 microinches (1,6 micrometers).

For repaired areas in Zone C only, proceed with operations 5, 6 and 7.

Locally swab etch repaired areas. Refer Overhaul Manual Chapter 72-09-14 Repair. Use Solution D.

6) Locally penetrant inspect repaired areas.

Refer to TSD 594-J TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002

7) Locally vapour blast using 300/500 mesh grit, 2N minimum almen intensity and 200% coverage to remove the effects of etchant.

Refer Overhaul Manual Chapter 72-09-13 Repair.

8) For corrosion pitting in excess of 0.002(0.05) or exceeding the 80% limit (Zone B only) it is permissible to skim turn the face to remove majority of pitting. Plucking or scuffing of surface is not acceptable. **NOTE:** Leave a minimum 0.002(0,05) tolerance for for finish machining.

Refer Figs. 401, 402, 403 and 404.

9) Finish grind defective/machined Alternatively: Face may be Care to be finish turned. taken to avoid tool chatter due to intermittent cuts.

Refer para 6 DATA.

10) Dimensionally inspect the chamfer at the 36 bolt hole positions (Zone B side only). Refer Fig. 403.

11) If required, chamfer the 36 bolt holes.

Refer Fig. 403.

12) Any remaining corrosion pitting or damage in Zone B may be removed by hand blending. Blends to be smooth and continuous with no sharp edges or corners.

Refer Repair Limitations. Refer Fig. 401. Use conventional hand tools. Refer Overhaul Manual. Chapter 72-09-22 Repair.

- 13) Hand polish blended areas to achieve a surface finish of 63 microinches (1,6 micrometers).
- 14) Visually inspect for removal of corrosion pitting and damage.
- 15) Inspect disk using the magnetic particle crack detection method.

Refer to TSD 594-J TASK 70-00-00-200-201.

16) Vapour blast repaired areas (not Zone C).

Refer Overhaul Manual Chapter 72-09-13 Repair. Use Procedure B.

17) Mark Repair Instruction number RI B511719 or R25 on component, adjacent to existing part number, using the vibropercussion engraving technique. Markings must not be closer than 0.030(0,75) to the blade slots.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.404.

NOTE: At this point Mod.72-9020 must be effected to post Mod.72-8925 components and to post Mod.72-8896 components if required. Re-part number accordingly. If Mod.72-9020 is not effected to post Mod.72-8896 components, complete repair with operations 15 to 18. For post Mod.72-9020 components, complete repair with operations 19 to 23.

18) Derust to remove all corrosion products.
NOTE: This procedure to be completed not more than 24 hours prior to painting.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use Process H.

19) Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots and hatched areas marked AD.

NOTE: Identity markings to remain visible after application of coating.

Refer TSD 594 OP.349 using Omat 7/46 (Type A, stoved at 515 deg.C or Type B coating).
Refer Figs.405, 406 and 407.

20) Apply corrosion resistant seal coating on top of the corrosion resistant coating.

Refer TSD 594 OP.349 using Omat 7/168

Note: Areas AE are "brush touched up" on assembly. (Refer to Fig. 405)

21) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.



FOR POST MOD.72-9020 COMPONENTS ONLY.

22) Derust to remove all corrosion products.

NOTE: This procedure to be completed not more than 24 hours prior to painting.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use Process H.

Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots (over areas marked AG) and hatched areas marked AD.

NOTE: Identity markings to remain visible after application of coating.

Refer TSD 594 OP.349 using Omat 7/46 (Type A stoved at 515 deg.C or Type B coating).
Refer Figs.405, 406, 407 and 408.

24) Apply corrosion resistant seal coating on top of the corrosion resistant coating. Refer TSD 594 0P.349 using Omat 7/168

NOTE: Areas AE are "brush touched up" on assembly. (Refer to Fig. 405)

25) Inspect fir tree root to blade clearance. Use blade root gauge or master top limit blade. Refer para 7. TOOLS item 1.

- 26) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.
 - MATERIAL

COMPONENT

MATERIAL

RR CODE

DISK, COMP. ROTOR, H.P. STAGE 3.

FV 535 MSRR 6519 **EBH**

- 6. DATA
 - (A) GRINDING DATA.

WHEEL TYPE: WHEEL SPEED: COMPONENT SPEED: MAX DEPTH OF CUT: COOLANT TYPE: 38 A60K VBE. 1200 r.p.m. 12 r.p.m. <u>+</u> 20%. 0.0002(0,005) per rev. CNS 30 or CSS 130.

REPAIR

72-33-02 Repair No. 25 Page 406 Dec 31/00 (B) TURNING DATA.

MACHINE:

VERTICAL LATHE

TOOL: FEED:

SINGLE POINT TUNGSTEN CARBIDE

0.006 (0,15) PER REV

COMPONENT SPEED: COOLANT TYPE:

14 r.p.m. CNS 30 or CSS 130.

7. TOOLS

TOOL NUMBER

DESCRIPTION

ITEM

\$3\$14926000

GAUGE

1

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

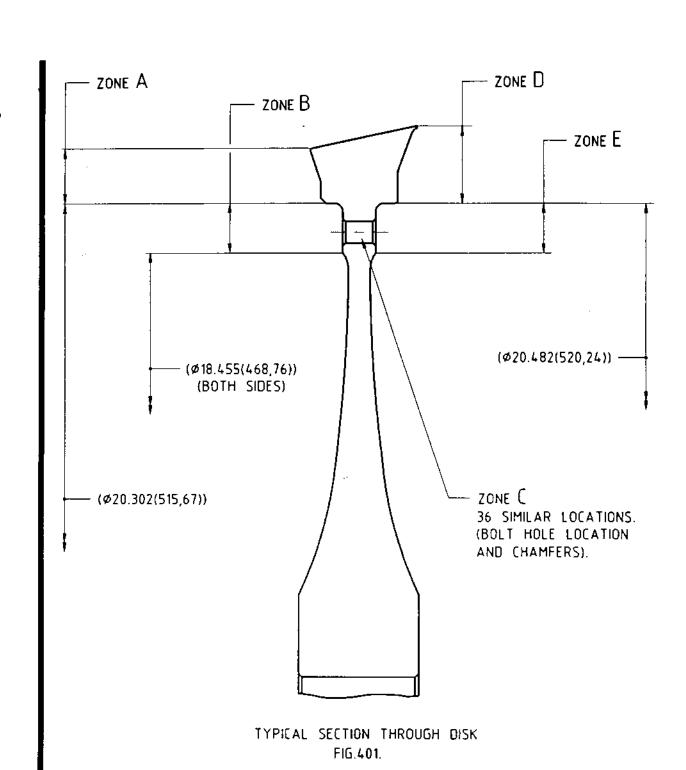
QUANTITY

ITEM

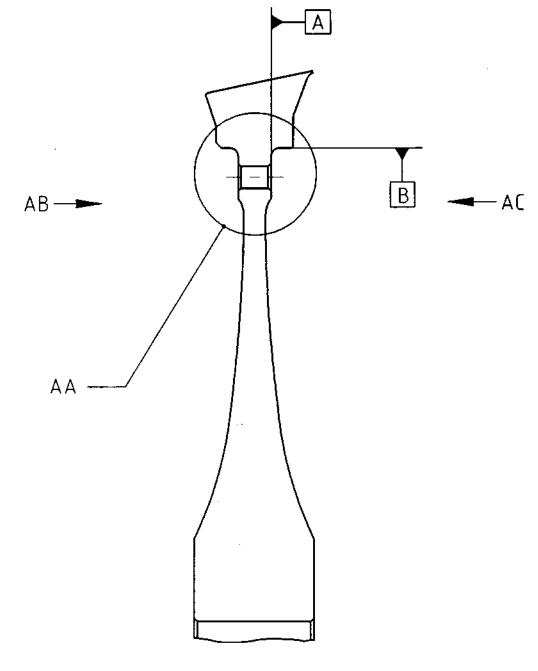
NONE.



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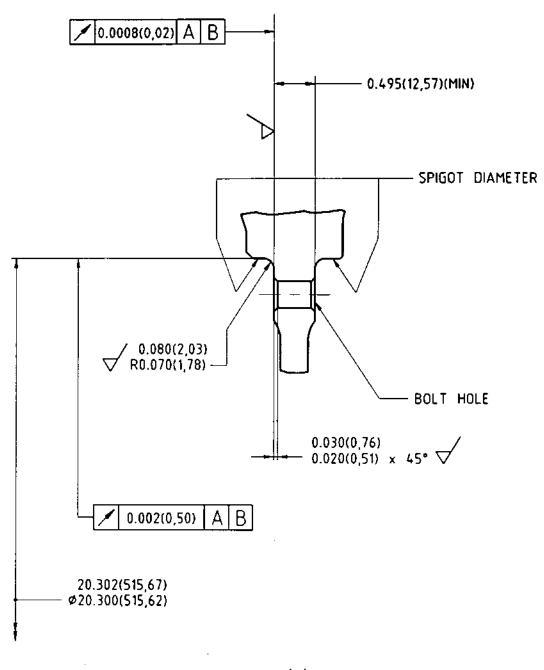


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TYPICAL SECTION THROUGH DISK FIG.402.

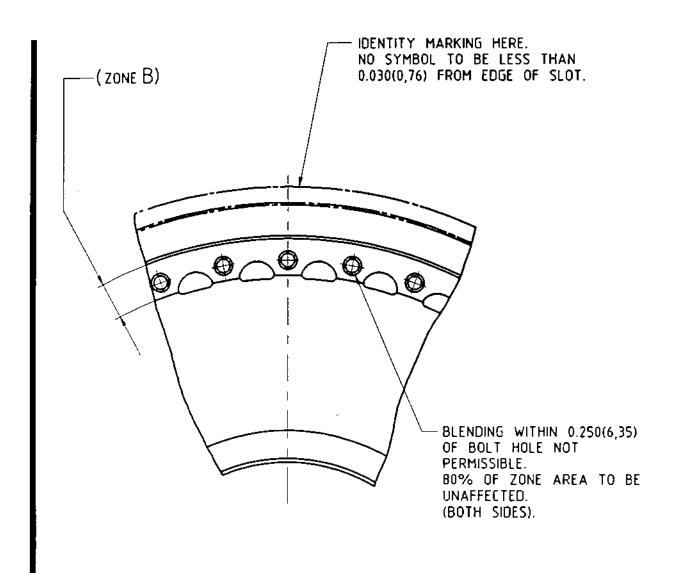
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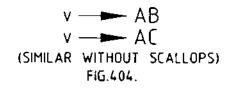


V AT AA FIG.403.

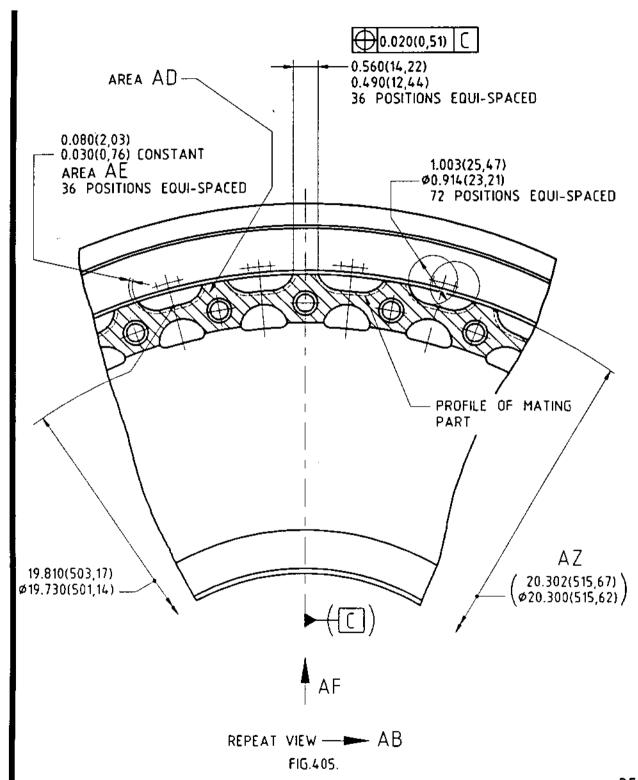
REPAIR
72-33-02
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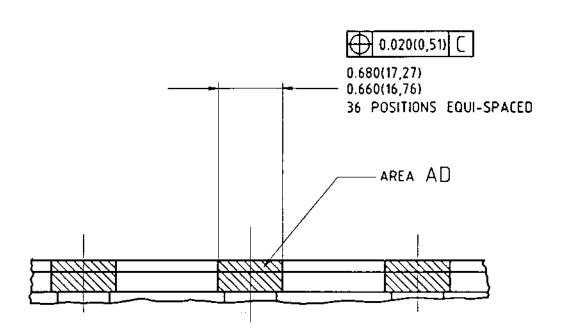


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72-33-02
Repair No. 25
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Jun 1/96

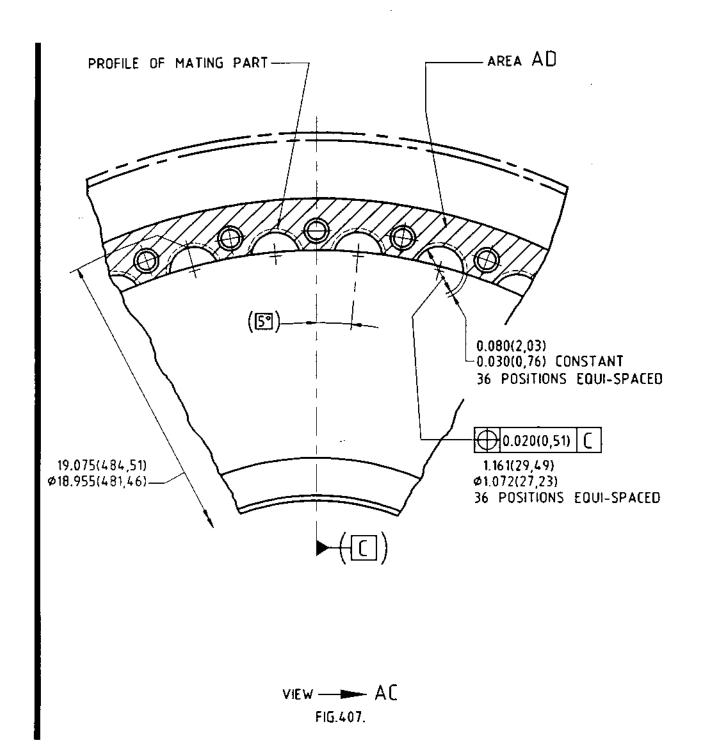




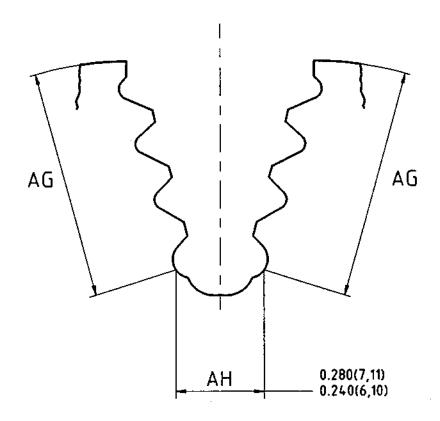
DEVELOPED V - AF
ON DIAMETER AZ

FIG.406

REPAIR 72-33-02 Repair No. 25 Page 412 Jun 1/96



REPAIR 72-33-02 Repair No. 25 Page 413 Jun 1/96



NOTE: AREA AH TO COVER TOTAL LENGTH OF SLOT.

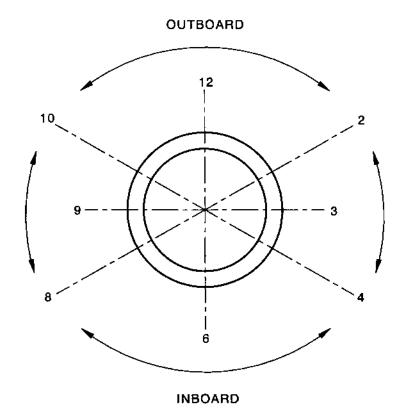
NO OVERSPRAY IS PERMITTED ON THE
FIR-TREE SLOT AREAS MARKED AG PROTECTIVE
COATING MAY BE BRUSH APPLIED PROVIDED THAT
EVEN COVERAGE AND 'WETTING' IS OBTAINED.

TYPICAL VIEW ON FIR TREE ROOT SLOT SHOWING AREA OF PROTECTIVE COATING FIG.408.

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REPEAT VIEW **AB** (SHOWING BOLT HOLE CLOCK POSITIONS ONLY)

FIG. 409

72-33-02

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HP COMPRESSOR SEVENTH STAGE ROTOR DISKS - REPAIR REMOVAL OF MINOR DAMAGE BY BLENDING

MODIFICATION NO. 8932C

1. <u>Effectivity</u>

2. Introduction

A. General

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 133/B512154.

- (1) This repair describes the procedure for restoring HP compressor rotor disks stage 7 by blending and polishing to remove minor damage.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) The operations that are subject to Component Manufacturing Technique control are indicated CMT.
- (5) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (6) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.

REPAIR 72-33-02 Repair No.26 Page 401 Jun 1/90



- (7) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (8) Surface texture is to be 63 micro-inches (1,6 micrometres) unless otherwise stated.
- (9) All tools referred to by item number in procedural steps are detailed in para.4.
- (10) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

B. Repair Limitations

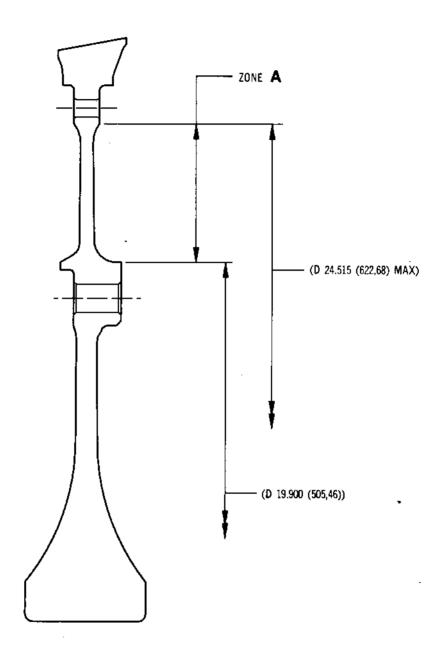
- (1) Repair may be carried out in Zone A only (Ref.Fig.401).
- (2) Maximum blend depth is 0.002 in. (0,05 mm).
- (3) For re-application of this repair, the total blend depth must not exceed the repair limitations.

3. <u>Instructions</u>

- A. Blend and Polish
 - (1) Blend the damaged areas within the repair limitations using conventional hand tools. Blends must be continuous with no sharp edges or corners.
 - (2) Polish the blended areas by hand to achieve a finish of 63 micro-inches (1,6 micro-metres).
- B. Inspect
 - (1) Visually inspect the disk for the removal of damage.
- C. Etch
 - (1) Mask up and locally swab-etch the polished areas as instructed in Chapter 72-09-14 Repair, using Solution C.
 CMT
 - (2) Remove masking.

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TYPICAL SECTION THROUGH DISK

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

HP Compressor Rotor Disk Stage 7 Figure 401

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D. Inspect

(1) Inspect the disk for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02 Inspection/Check. CMT

E. Vapour Blast

(1) Vapour blast the polished areas as instructed in Chapter 72-09-13 Repair, using procedure B. CMT

F. Identify

(1) Mark SAL B.512154 adjacent to the existing part number, using vibro-percussion engraving as instructed in Chapter 72-09-00 Repair. Marking must not be less than 0.030 in. (0,76 mm) from the edge of the blade slots.

G. Final Inspection

- (1) Finally inspect the disk to ensure that the repair has been carried out satisfactorily and that the disk is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.



HP COMPRESSOR ROTOR SHAFT FRONT - LABYRINTHS NO'S - 6, 7 AND 8 RESTORED BY TIG WELDING

MODIFICATION NO. OL.8927C

1. Effectivity

| <u> 1.P.C.</u> | <u>Fig.</u> | /Item | <u>Part Number</u> |
|----------------|-------------|-------|--|
| 72-33-02 | 1 | 260A | B922639, B922640, B922905, B922906, B922907, B922908 |
| · · | 1 | 2608 | 8927125, B927126, B927129, B927130, B927131, B927132, B930066, B930067, B930068, B930069, B930070, B930071, B930072, B930073, B930074, B930075, B930076, B930077 |
| | 1 | 260¢ | в930192, в930193 |
| | 1 | 260D | B513748, B513749 |

2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 139/8508136-8.

- (1) This repair describes the procedure for restoring the labyrinths number 6, 7 and 8 by mechanised TIG welding, and machining to the standard dimensions.
- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) The operations that are subject to Component Manufacturing Technique control are indicated CMT.
- (5) A test piece shall be produced and subjected to metallurgical examination; test pieces are required initially and upon any change of airline operator, sub-contractor, machine or welding equipment. Test pieces are also required after every ten component repairs or annually, where time elapsed between component repairs exceeds one year.

REPAIR

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- (6) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (7) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (8) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (9) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.
- (10) All tools referred to by item number in procedural steps are detailed in para.5.
- (11) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. Test Piece

- A. Produce Test Piece.
 - (1) Produce a test piece from fully heat-treated MSRR.8634 or MSRR.8663 material to the dimensions given in Figure 401. It is permissible to use an unserviceable standard part as a test piece. In this case, machine the labyrinth fins to the dimensions given in Figure 403.
 - (2) Remove the sharp edges from the fin.
 - (3) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.
- B. Weld Test Piece.
 - (1) Build up the single fin to a minimum height of 0.075 in. (1,91 mm) as indicated in Figure 401 by mechanised TIG welding using filler rods 0Mat 366 as instructed in TSD 594 OP 409. For welding data, refer to paragraph 7.
 - (2) Build up the blanket weld with a single weld run only, as indicated in Figure 401 by mechanised TIG welding using filler rods MSRR.9500/70 as instructed in TSD 594 OP 409. For welding data, refer to paragraph 7.

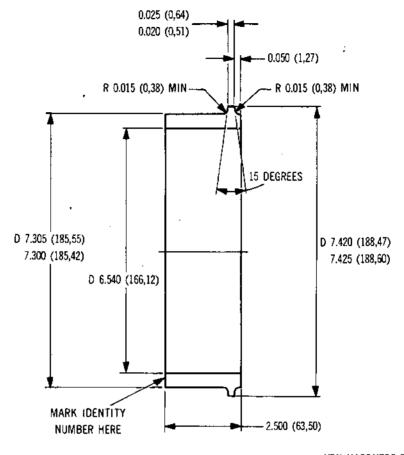
REPAIR 72-33-02 Repair No.27 Page 402 Dec 1/97

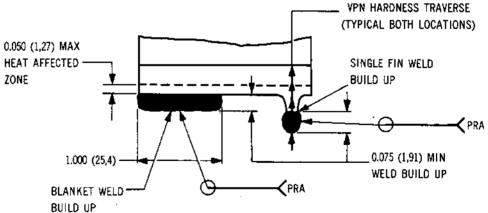


C. Machine.

- (1) Locate the test piece in a lathe and machine the blanket weld only, removing the minimum material, until the surface is free of defects, e.g. voids, porosity, etc.
- D. Inspect.
 - (1) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.
- E. Weld.
 - (1) Repeat operations in paragraphs 3B(2) to 3D until the minimum build-up is achieved (Ref.Fig.401).
- F. Identify.
 - (1) Mark B508139 on the test piece using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.
- G. Inspect.
 - (1) Inspect the blanket weld only, using the ultrasonic C-scan process as specified in Chapter 72-09-00 Inspection/Check.
- H. Metallurgical Examination.
 - NOTE: The following examination must be carried out by the controlling laboratory.
 - (1) Produce four suitable micro-sections at 90 deg. from the test piece surface.
 - (2) Subject the micro-sections to a VPN hardness check using a 5 kg load and a 2/3rds objective at 0.020 in. (0,51 mm) increments, traversed across the microsections. Check that the heat affected zone is limited to the area shown in Figure 401 (test piece) or Figure 405 (unserviceable standard part).







DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Test Piece Details Figure 401

72-33-02 Repair No.27 Page 404 Jun 1/90

4. <u>Instructions.</u>

- A. Machine.
 - (1) Locate the rotor shaft front on a centre-lathe, with the large flange secured to a faceplate. Set true to datum diameters A and B (Ref.Fig.402).
 - (2) Machine the seal fins of the No's.6, 7 and 8 labyrinths to the dimensions given in Figure 403.
 - (3) Remove burrs and sharp edges.
- B. Inspect.
 - (1) Inspect for the satisfactory completion of the machining operation.
 - (2) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in Chapter 72-33-02 Inspection/Check.

CMT

(3) Measure and record the position of the fins on labyrinths No's.7 and 8 (Ref.Fig.404).

C. Weld.

(1) Build up the fins of the No's.7 and 8 labyrinths as indicated in Figure 405, by mechanised TIG welding using filler rods OMat 366 as instructed in TSD 594 OP 409. Weld build-up must be sufficient to allow finish dimensions to be achieved (Ref.Fig.406 and 407). For welding data, refer to paragraph 7.

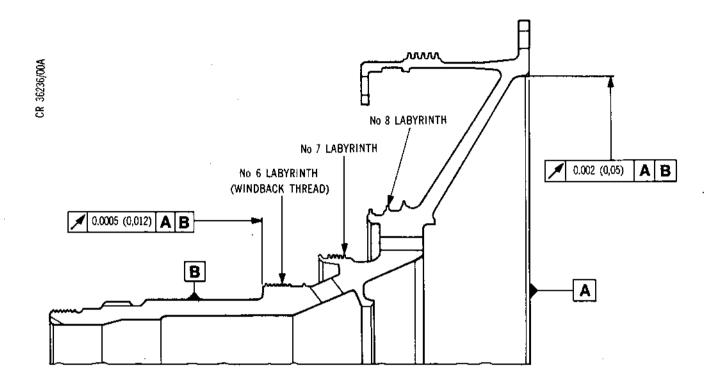
CMT

(2) Build up the No.6 labyrinth location as indicated in Figure 405, by a single weld run only, using mechanised TIG welding with filler rods OMat 366 as instructed in TSD 594 OP 409. For welding data, refer to paragraph 7.

CMT

REPAIR



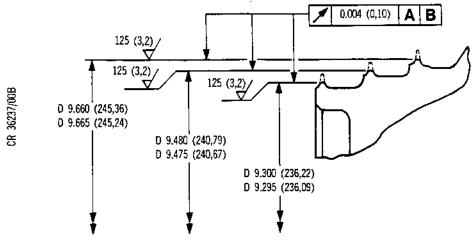


TYPICAL SECTION THROUGH SHAFT

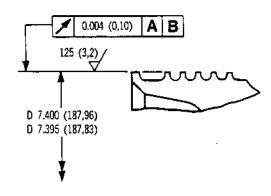
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

> Rotor Shaft Front Figure 402

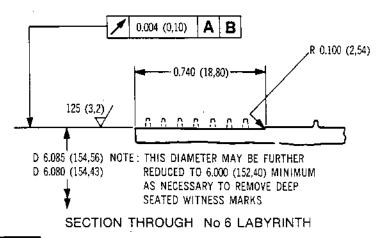
72-33-02 Repair No.27 Page 406 Jun 1/90 K.610-14-28 snecma OVERHAUL



SECTION THROUGH No 8 LABYRINTH



SECTION THROUGH No 7 LABYRINTH

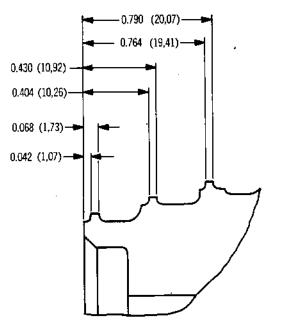


DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

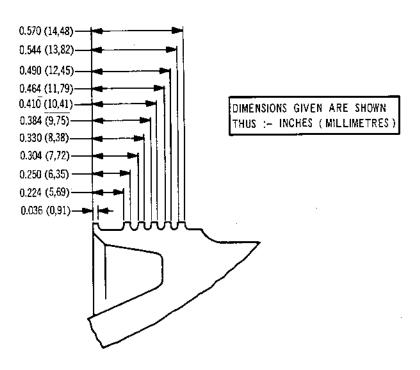
Machining Details Figure 403

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Repair No.27
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33 13 14 SECTION THROUGH No 8 LABYRINTH



SECTION THROUGH No 7 LABYRINTH

Reference Dimensions Figure 404

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D. Machine.

- (1) Locate the shaft on a centre-lathe with the large flange secured to a faceplate. Set true to datum diameters A and B (Ref.Fig.402).
- (2) Machine the No.6 labyrinth seal location, removing the minimum material, until the surface is free of all defects, e.g. voids, porosity etc.

E. Inspect.

(1) Inspect the No's.6, 7 and 8 seal locations using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02, Inspection/Check.
CMT

F. Weld.

(1) Repeat the welding, machining and inspection operations for labyrinth No.6 only as instructed in paragraphs 4C(2), 4D and 4E, until sufficient material is built up to achieve the finish dimensions (Ref. Fig. 408).

G. Inspect.

- (1) Inspect the shaft for distortion (Ref.Fig.402).
- (2) Inspect the welding as detailed in TSD 594 OP 4D9.

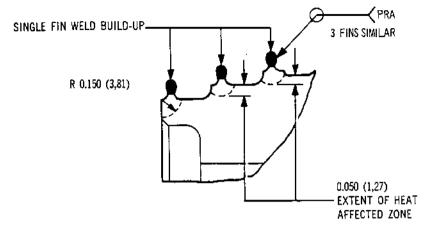
(3) Inspect the shaft using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02 Inspection/Check.

CMT

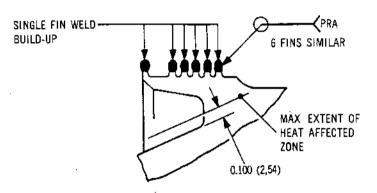
CMT

(4) Inspect the No.6 labyrinth location using the ultrasonic C-scan process, as specified in Chapter 72-09-00 Inspection/Check.

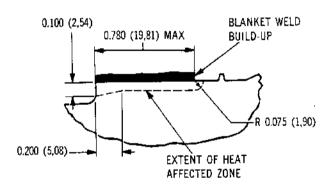
72-33-02
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Page 409
Jun 1/90



SECTION THROUGH No 8 LABYRINTH



SECTION THROUGH No 7 LABYRINTH

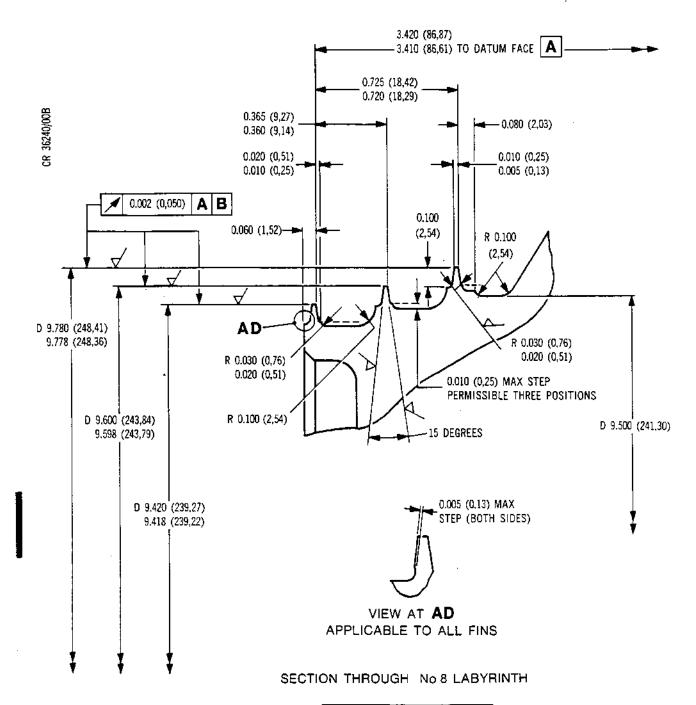


SECTION THROUGH No 6 LABYRINTH

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Welding Details Figure 405

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DIMENSIONS GIVEN ARE SHOWN THUS :~ INCHES (MILLIMETRES)

Machining Details Figure 406

REPAIR 72-33-02 Repair No.27 Page 411 Jan 31/94

H. Machine.

- (1) Locate the shaft on a centre-lathe with the large flange secured to a faceplate. Set true to datum diameters A and B (Ref.Fig.402).
- (2) Finish machine the fins of No's.7 and 8 labyrinths using form tools ref. tool items 2 and 4 for labyrinth No.7 and tool item 5 for labyrinth No.8, to the dimensions given in Figures 406 and 407. Use the dimensions previously recorded (para.48(3)) to ensure that the maximum step is 0.005 in. (0,13 mm) (Ref.Fig.406 view AD).

CMT

(3) Finish machine the No.6 labyrinth (windback seal) using form tool ref. tool items 1 and 3, to the dimensions given in Figure 407.

CMT

J. Inspect.

- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Chemically etch the repaired areas as instructed in Chapter 72-09-14 Repair, using Solution A.

CMT

(3) Inspect the shaft using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02 Inspection/Check.

CMT

K. Vapour Blast.

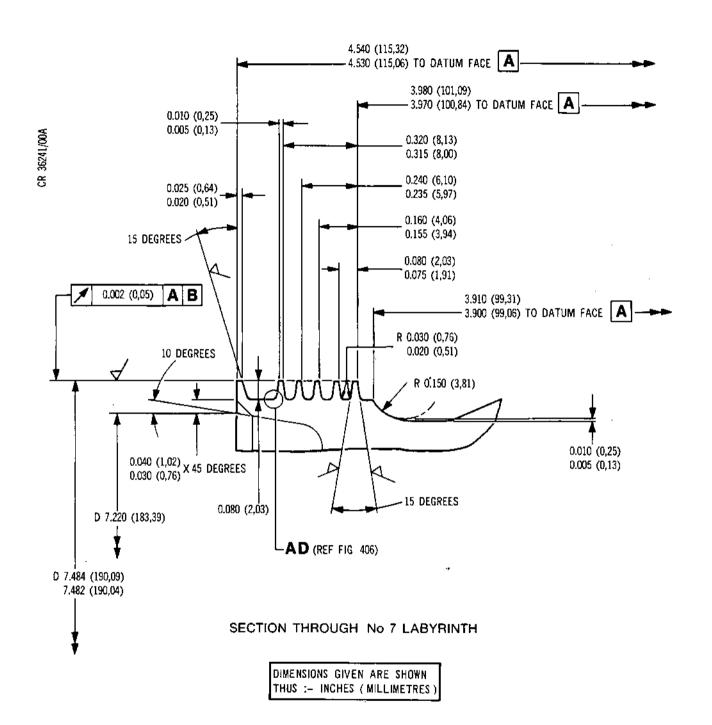
- (1) Mask off the shaft with suitable waterproof masking tape. Ensure that only the repair area is exposed.
- (2) Vapour blast the labyrinth fins as instructed in Chapter 72-09-13 Repair, using 320/400 mesh aluminium oxide grit at Almen 2N intensity (minimum).

CMT

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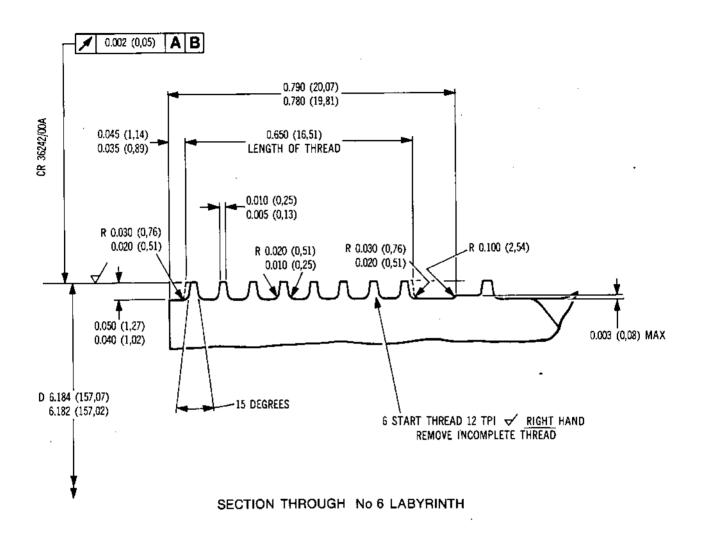
REPAIR



Machining Details Figure 407

> 72-33-02 Repair No.27 Page 413 Jun 1/90





DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Machining Details Figure 408

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L. Identify.

(1) Mark the appropriate salvage number (Ref. Table 401) adjacent to the existing part number, using vibropercussion marking as specified in Chapter 72-09-00 Repair.

| SALVAGE NO. | LABYRINTH NO. | TEST PIECE |
|-------------|---------------|------------|
| B508136 | 6 | B508139 |
| B508137 | 7 | B508139 |
| B508138 | 8 | 8508139 |

Table 401

M. Final Inspection.

(1) Finally inspect the shaft to ensure that the repair has been carried out satisfactorily and that the shaft is in a serviceable condition.

5. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | <u>Part No.</u> | <u>Item</u> |
|--------------------|-----------------|-----------------|-------------|
| Form tool | 1 | S3S15508000 | 1 |
| Form tool | 1 | S3S15509000 | 2 |
| Form tool | 1 | \$3\$15510000 | 3 |
| Form tool | 1 | \$3\$15511000 | 4 |
| Form tool | 1 | \$3\$15547000 | 5 |

6. Replacement Parts

None.



7. Welding Machine Data

A. Labyrinth No.7 and 8 Fins.

Material : Titanium IMI 550

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991.5 L/h)

Trailing Gas : Argon

Gas Flow Rate : 10 CFH (330.5 l/h)

Voltage (AVC) : 7.3

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.7

Welding Current

Fusion Mode : Pendant Setting 29 Amps

Weld Mode : Pendant Setting 37 Amps

Filler Material Spec. : OMat 366

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REPAIR



MK.610-14-28 snecma OVERHAUL

Size : 0.030 in. (0,76 mm) dia.

feed Rate : 5.6 IPM (142,2 mm/min.)

Filler Wire Start Delay : 1.7

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 348

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 90

Weld Mode : 110

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

COMMENTS: Set table at 900, wire brush after each weld

deposit.

B. Labyrinth No.6 (Blanket Weld)

Material : Titanium IMI 550

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tunasten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : HY-PLAS

Gas Flow Rate : 35 CFH (991.5 l/h)

Trailing Gas : -

REPAIR

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OVERHAUL

Gas Flow Rate :

Voltage (AVC) 8.2

Deadband

Sensitivity 3

Lock Out Νo

0 Retract Distance

0.05 Starting Arc Gap

2.7 Start Delay

Welding Current

Fusion Mode Pendant Setting 35 Amps

Weld Mode Pendant Setting 36 Amps

Filler Material Spec. OMat 366

0.030 in. (0,76 mm) dia. Size

8.0 IPM (203,2 mm/min.) Feed Rate

Filler Wire Start Delay 2.3

Filler Wire Stop Delay 0.1 :

Dabber Strokes/Min 256 :

0.470 in. (12 mm) Stroke Length

Pulsation No

Weld Speed

50 Fusion Mode

Weld Mode 50

All readings shown are machine dial readings unless NOTE:

otherwise indicated.

Set table at 800, wire brush after each weld **COMMENTS:**

deposit.

REPAIR

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SHAFT, ROTOR, FRONT

PROVISION FOR THE REMOVAL AND REPLACEMENT OF DEFECTIVE TUNGSTEN CARBIDE/COBALT COATING AT THRUST BEARING LOCATION.

B512713

1. EFFECTIVITY

| IPC | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|-----------------|
| 72-33-02 | 1 /260A | В922639 |
| | | B922640 |
| | | B922905 |
| | | B922906 |
| | | B922907 |
| | | B922908 |
| | 1 /260B | B927125 |
| | | B927126 |
| | | B927129 |
| | | B927130 |
| | | B927131 |
| | | В927132 |
| | | B930066 |
| | | B930067 |
| | | 8930068 |
| | | 8930069 |
| | | B930070 |
| | | В930071 |
| | | В930072 |
| | | В930073 |
| | | B930074 |
| | | B930075 |
| | | B930076 |
| | 4 12/04 | B930077 |
| | 1 /2600 | B930192 |
| | | в930193 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

NOTE:-

Geometric tolerances and dimensions apply in the restrained condition.

REPAIR 72-33-02 Repair No. 28 Page 401 Jan 31/94

3. **GENERAL**

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Chemically remove defective Tungsten carbide/Cobalt coating from bearing location diameter. Refer TSD594 OP.107, Appendix 5.

Alternative:
Set shaft true and grind to completely remove defective
Tungsten carbide/Cobalt coating from bearing location diameter.
Note: Ensure minimum diameter
AG is observed.

Refer fig. 401 and 402. Refer Para. 6.A. Grinding wheel data.

2) Inspect for complete removal of coating.

- Refer Overhaul Manual Chapter 72-09-14 Repair solution A.
- 3) Locally dye penetrant inspect repair area.
- Refer Overhaul Manual Chapter 72-33-02 Inspection/Check.
- 4) Apply Tungsten carbide/Cobalt coating within area designated AF. Maximum coating thickness should not exceed 0.010 (0,25).
- Refer Overhaul Manual Chapter 72-09-11 Repair using OMat 3/195 or 3/114. Refer fig.402.
- 5) Set true and grind to produce finished dimensions.
- Refer fig.401 and 402. Refer Para.6.A. Grinding wheel data.
- Visually inspect Repair area.
- Refer Overhaul Manual Chapter 72-09-11 Repair.
- Locally dye penetrant inspect repair area.

Refer Overhaul Manual Chapter 72-33-02 Inspection/ Check.

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Repair No. 28
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MK.610-14-28 snecma OVERHAUL

8) Mark Repair Instruction number RI B512713 or R28 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

9) Finally visually inspect the component to ensure the Repair has been carried out satisfactorily and that the Shaft, Rotor, Front is in a serviceable condition.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

TCT

SHAFT ROTOR FRONT

IMI 550 (Double V.M.) MSRR 8634

6. DATA

A) GRINDING WHEEL DATA

WHEEL: 39C 60F 9V OR 37C 60F 9V.

LUBRICANT: C.S.I. OR EQUIVALENT.

DEPTH OF CUT/PASS: ROUGH 0.0004 (0,010) MAXIMUM.

FINISH 0.0002 (0,005) MAXIMUM.

SPEED: 35 m/s.

WHEEL FEED: HAND.

SPEED (COMPONENT): 50 - 60 R.P.M

7. TOOLS

NONE.

8. REPLACEMENT PARTS

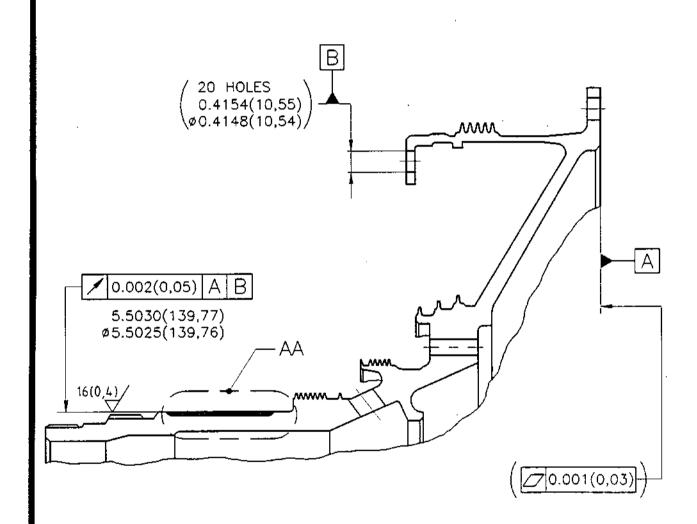
PART NUMBER

DESCRIPTION

ITEM.

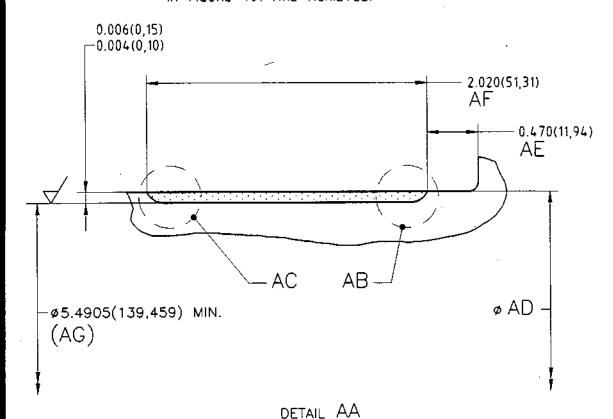
NONE.

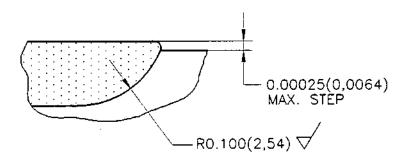
72-33-02 Repair No. 28 Page 403 Jan 31/94



TYPICAL SECTION THROUGH SHAFT FIG.401

REPAIR 72-33-02 Repair No. 28 Page 404 Jan 31/94 NOTE: DIAMETER AD MAY BE USED AS A CLOCKING FEATURE (OVER LENGTH AE) PROVIDING THE GEOMETRIC TOLERANCE REQUIREMENTS STATED IN FIGURE 401 ARE ACHIEVED.





DETAIL AB DETAIL AC SIMILAR

FIG.402

REPAIR 72-33-02 Repair No. 28 Page 405 Jan 31/94



<u>HP COMPRESSOR ROTOR - STAGE 2 TO 3 SPACER RING - NEUTRALISATION AND REMOVAL OF CORROSION</u>

MODIFICATION NO. 0L.8944C

1. Effectivity

| I.P.C. | - | <u>Fiq./Item</u> | <u>Part No.</u> |
|----------|---|------------------|--------------------|
| 72-33-02 | | 1 330 | B922835 B922836 |

2. Introduction

A. General.

CAUTION: COMPLIANCE WITH ALL ASPECTS OF THIS REPAIR PROCESS SHOULD BE ACHIEVED WITHOUT DEVIATION. WHERE DEVIATION IS CONSIDERED NECESSARY, REFERENCE MUST BE MADE TO THE REPAIR AUTHORITY FOR AGREEMENT.

- (1) This repair describes the procedure for neutralising and removing corrosion from the stage 2 to 3 spacer ring.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 63 micro-inches (1,6 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.



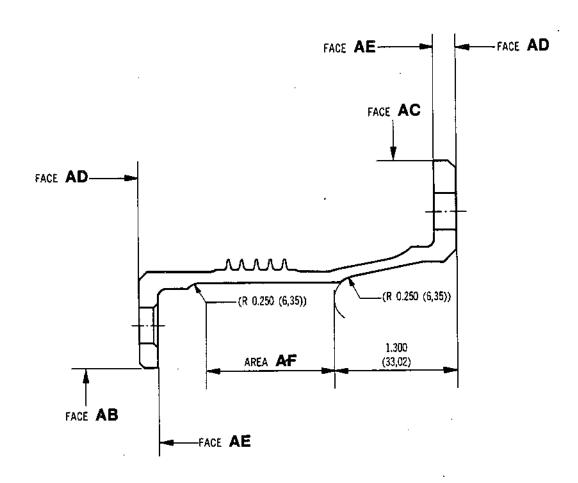
(9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations (Ref. 72-09-20 Repair).

3. <u>Instructions</u>

- A. Remove Protective Coating.
 - (1) Remove the aluminium paint using cleaning process F. For procedure, refer to Chapter 72-09-00 Cleaning.
- B. De-scale.
 - (1) De-scale the spacer using cleaning process L (Method 1 only). For procedure, refer to Chapter 72-09-00 Cleaning.
- C. Inspect.
 - (1) Inspect the spacer for cracks using the magnetic particle process specified for this component in Chapter 72-33-02 Inspection/Check.
- D. Identify.
 - (1) Mark salvage number SAL.B512919 within area AF (Ref. Fig.401) adjacent to the existing part number, using vibro-percussion engraving as instructed in Chapter 72-09-00 Repair.
- E. De-rust.
 - (1) Remove rust from the spacer using cleaning process H. For procedure, refer to Chapter 72-09-00 Cleaning.
- NOTE: This procedure must be completed not more than 24 hours before the finish is applied (Ref. paragraph 3F).

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TYPICAL SECTION THROUGH SPACER

DIMENSIONS GIVEN ARE SHOWN THUS :-- INCHES (MILLIMETRES)

HP Compressor Spacer Stage 2-3 Figure 401

72-33-02 Repair No.29 Page 403 Dec 1/90



- F. Apply Finish.
 - NOTE: Spacers B922835 and B922836 may be modified to the standard of Service Bulletin 72-8896-347 at this stage if required. Refer to S B for details. If the spacers are to be modified, omit the process in the following paragraph.
 - (1) Apply high heat resistant aluminium paint to the spacer, all over except spigot diameters AB and AC, bolt-holes, faces AD and areas 0.650 in. (16,51 mm) diameter around the bolt-holes on faces AE (Ref.Fig. 401). For procedure, refer to Chapter 72-09-04 Repair.
- G. Final Inspection.
 - (1) Finally inspect the spacer to ensure that the repair has been carred out satisfactorily and that the spacer is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None

5. Replacement Parts

None



HP COMPRESSOR ROTOR - STAGE 2 TO 3 SPACER RING - REMOVAL OF CORROSION ON REAR FLANGE FRONT FACE BY MACHINING

MODIFICATION NO. OL.8943C

Effectivity

| I.P.C. | <pre>Fig./Item</pre> | <u>Part No.</u> |
|----------|----------------------|--------------------|
| 72-33-02 | 1 330 | B922835 B922836 |

2. Introduction

A. General.

CAUTION: COMPLIANCE WITH ALL ASPECTS OF THIS REPAIR PROCESS SHOULD BE ACHIEVED WITHOUT DEVIATION. WHERE DEVIATION IS CONSIDERED NECESSARY, REFERENCE MUST BE MADE TO THE REPAIR AUTHORITY FOR AGREEMENT.

- (1) This repair describes the procedure for machining the rear flange front face of the spacer ring stage 2-3 to remove corrosion.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.

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Repair No.30
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Dec 1/90



- (7) Surface texture is to be 63 micro-inches (1,6 micrometres) unless otherwise stated.
- (8) Geometric tolerances and dimensions apply in the restrained state.
- (9) All tools referred to by item number in procedural steps are detailed in para.4.
- (10) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations (Ref.72-09-20 Repair).

3. Instructions

- A. Remove Protective Coating.
 - (1) Remove the aluminium paint using cleaning process F. For procedure, refer to Chapter 72-09-00 Cleaning.
- B. De-scale.
 - (1) De-scale the spacer using cleaning process L (Method 1 only). For procedure, refer to Chapter 72-09-00 Cleaning.
- C. Machine.
 - (1) Locate the spacer to the face plate of a vertical lathe and set true to datum diameter B and datum face A (Ref.Fig.401).

NOTE: Any fixtures required are to be manufactured locally.

(2) Machine the front face of the rear flange to remove corrosion, within the limit given in figure 401, observing the following conditions:

Tool : K5

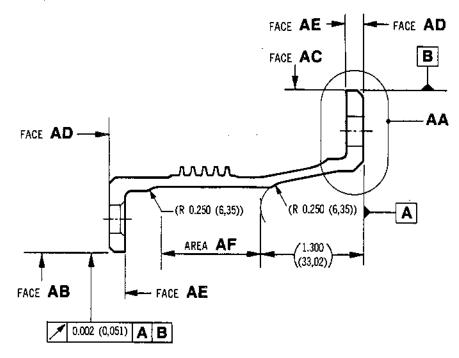
Tool feed : 0.006/0.004 in.

(0,15/0,10 mm) per rev.

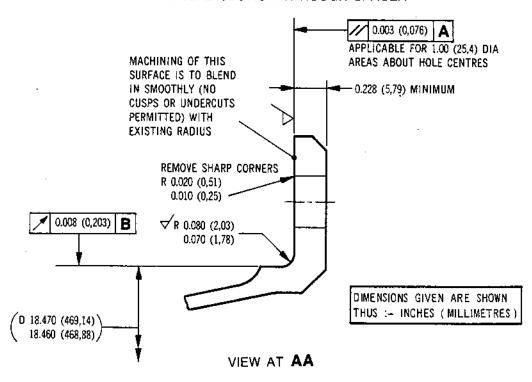
Component speed : 40.0/31.5 rpm

Coolant type : CSS 127

Plucking or scuffing of the surface is inacceptable.



TYPICAL SECTION THROUGH SPACER



HP Compressor Spacer Stage 2-3 Figure 401

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- D. Inspect.
 - (1) Visually inspect for the removal of corrosion.
 - (2) Inspect the spacer for cracks using the magnetic particle process specified for this component in Chapter 72-33-02 Inspection/Check.
- E. Vapour Blast.
 - (1) Vapour blast the machined areas as instructed in Chapter 72-09-13 Repair, using procedure B.
- F. Identify.
 - (1) Mark salvage number SAL B512824 within area AF (Ref.Fig.401) adjacent to the existing part number, using vibro-percussion engraving as instructed in Chapter 72-09-00 Repair.
- G. De-rust.
 - (1) Remove rust from the spacer using cleaning process H. For procedure, refer to Chapter 72-09-00 Cleaning.
 - NOTE: This procedure must be completed not more than 24 hours before the finish is applied (Ref.paragraph 3H).
- H. Apply Finish.
 - NOTE: Spacers B922835 and B922836 may be modified to the standard of Service Bulletin 72-8896-347 at this stage if required. Refer to 5B for details. If the spacers are to be modified, omit the process in the following paragraph.

- (1) Apply high heat resisting aluminium paint to the spacer, all over except spigot diameters AB and AC, bolt holes, faces AD and areas 0.650 in. (16,51 mm) diameter around the bolt holes on faces AE (Ref. Fig.401). For procedure, refer to Chapter 72-09-04 Repair.
- J. Final Inspection.
 - (1) Finally inspect the spacer to ensure that the repair has been carried out satisfactorily and that the spacer is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

| Description | <u>Qty</u> | Part No. | <u>Item</u> |
|--------------------|------------|----------|-------------|
| Carbide Lathe Tool | 1 | к5 | 1 |

Any fixtures required are to be manufactured locally.

5. Replacement Parts

None



HIGH PRESSURE COMPRESSOR SPACER RINGS - REPAIR BLENDING OF SCORING AND/OR GOUGING ON RETAINING BOLT LOCATING DIAMETER STAGES 3-4, 4-5, 5-6, AND 6-7

MODIFICATION NO. OL.8960

1. Effectivity

| I.P.C. | <u>Fig.</u> | ./Item | <u>Part No.</u> |
|----------|-------------|--------|-----------------|
| 72-33-02 | 1 | 380 | 8922839 |
| | 2 | 50 | B922843-4 |
| | 2 | 100 | B922847-8 |
| | 3 | 390 | B922851-6 |

2. Introduction

A. General.

- (1) This repair describes the procedure for the removal of scoring on the retaining bolt diameters of the 3-4, 4-5, 5-6, and 6-7 stage Spacer Rings of the High Pressure Compressor.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of these repair should be achieved without deviation. Where a need to deviate is considered necessary then reference should be made to the Repair Authority.
- (2) This repair instruction permits removal of high metal and sharp edges only from all dee-head bolt locations.

CAUTION: IF RE-APPLICATION OF REPAIR IS NECESSARY, TOTAL BLEND DEPTH SHALL NOT EXCEED THE OVERALL LIMITS QUOTED IN THIS REPAIR. (REFER TO FIGS.402 AND 403).

REPAIR

72-33-02 Repair No.31 Page 401 Jan 4/93

3. Instructions

- A. Preparation.
 - (1) Check that damage does not encroach into existing radius 'AA' (Ref. Figs. 401 to 403).
- B. Removal of Damage.
 - CAUTIONS: 1. WHEN BLENDING, REMOVE ONLY THE MINIMUM AMOUNT OF MATERIAL NECESSARY.
 - 2. LOAD/PRESSURE APPLIED WHEN USING EQUIPMENT DETAILED IN PARA.4 SHOULD NOT BE SUFFICIENTLY GREAT SO AS TO PRODUCE SMOKING AND/OR AN UNPLEASANT ODOUR FROM THE ABRASIVE AGENT IN THE ABRASIVE WHEEL.
 - (1) Using hand tools only (Ref. para.4), carefully blend to remove high metal and sharp edges only. Residual depth of defect after removal of metal 0.025 in. (0,64 mm) maximum (Ref. Figs.401 to 403).
 - (2) Polish blended areas to achieve a surface finish of 63 microinches (1,6 micrometers) using fine grade emery cloth.
- C. Etch.

Locally swab etch the repaired areas with Solution C, using procedure defined in Chapter 72-09-14, Repair, para.J.

- D. Inspect.
 - (1) Carry out binocular inspection of repaired areas at x15 magnification.
 - (2) Carry out crack detection process specified for this components at Chapter 72-33-02, Inspect.
- E. Restore Surface Finish.

Vapour blast repaired areas using 300/400 mesh aluminium oxide grit, almen intensity 2N minimum, using procedure specified in Chapter 72-09-13, Repair, para.J, Procedure B.

F. Identify.

Mark SAL B513459 or R31 adjacent the existing part number using vibro-percussion marking as specified in Chapter 72-09-00, Repair.

REPAIR

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4. Special Tools, Fixtures and Equipment

The definition of the term "hand tools only" is deemed to imply that the following may be used:

Gun - Ushio Air Tool Company Ltd., Type MSG-3BSN 65,000 R.P.M.

Wheel - Master Abrasive Type A120HFX

5. Replacement Parts

None.

| SPACER STAGE | PART NUMBER | RADIUS 'AA' |
|--------------|-------------|------------------------------|
| 3-4 | B922839 | 0.120 (3,05) 0.110 (2,79) |
| 4-5 | B922843-4 | 0.150 (3.81) 0.140 (3,56) |
| 5-6 | B922847-8 | 0.150 (3,81) 0.140 (3,56) |
| 6-7 | B922851-6 | 0.060 (1.52) 0.050 (1.27) |
| |) | |

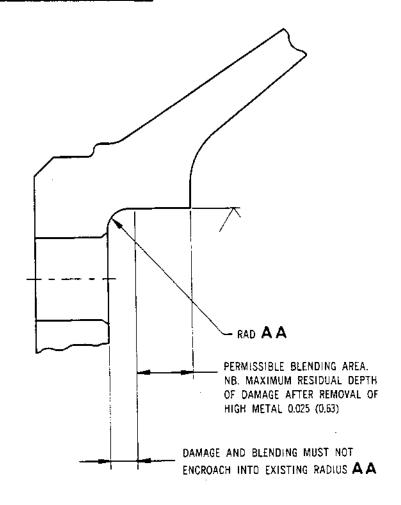
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

> Radius Values Figure 401

REPAIR
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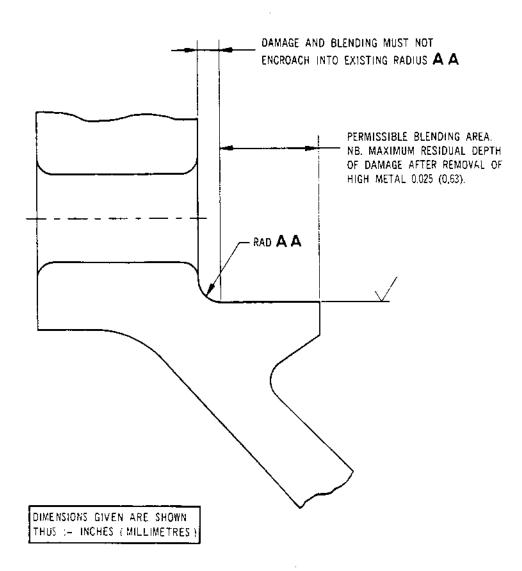
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



Spacer Ring Blending Limitations, Stages 3-4, 4-5 and 5-6 Figure 402

REPAIR

72-33-02 Repair No.31 Page 405 Jan 4/93



Spacer Ring Blending Limitations, Stage 6-7 Figure 403

REPAIR

72-33-02 Repair No.31 Page 406 Jan 4/93



TUBE, ASSEMBLY OF, AIR TRANSFER

PROVISION FOR RESTORATION OF WORN BELL-END BORE BY PLASMA SPRAYING

REPAIR NO. B513509

1. EFFECTIVITY

IPC Fig./Item Part No.

72-33-02 3 400B B927840

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair may only be used when:-

- 1) Diameter AA does not exceed 12.235 (310,77). Refer fig.401.
- 2) After machining to remove coating, the resultant wall section is not less than 0.080 (2,79). Refer fig.401.
- 3) After finish machining, coating thickness does not exceed 0.025 (0,64).

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

AS AN ALTERNATIVE TO EFFECTING THIS REPAIR, IT IS PERMISSIBLE TO EFFECT SB.72-8975-381. IF SERVICE BULLETIN IS EFFECTED, NEW PART NUMBER MUST BE MARKED ON COMPONENT ADJACENT TO EXISTING. IF SERVICE BULLETIN IS NOT EMBODIED, PROCEED WITH REPAIR AS FOLLOWS.

REPAIR

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| 1) | Dimensionally inspect. Ensure |
|----|-------------------------------|
| | diameter AA does not exceed |
| | the stated dimension. |

Refer fig.401.

2) Load component on machine and set true to datum A. Machine to completely remove coating. Remove minimum amount of parent material to clean up.

Refer fig.401. Refer repair limitations. Refer para.7. TOOLS.

Locally swab etch to ensure coating is completely removed. Refer Overhaul Manual Chapter 72-09-14 Repair, Solution E.

4) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210.

5) Dimensionally inspect.

Refer fig.401.
Refer repair limitations.

6) Mask off areas not to be coated. Spray machined diameter with bond coat followed by top coat.

NOTE: Bond coat to be of sufficient thickness to allow achievement of 0.006/0.008 (0,15/0,20) top coat thickness after finish machining.

Refer Overhaul Manual Chapter 72-09-06 Repair and TSD 594 OP.704 using bond coat OMat 3/188 and top coat OMat 3/81. Refer repair limitations.

7) Visually inspect coating for defects.

Refer TSD 594 OP.704 section 8.

8) Load component on grinding machine and set true to datum A. Machine to produce finished dimensions.

Refer fig.401. Refer para.7. TOOLS.

9) Dimensionally inspect.

Refer fig.401.

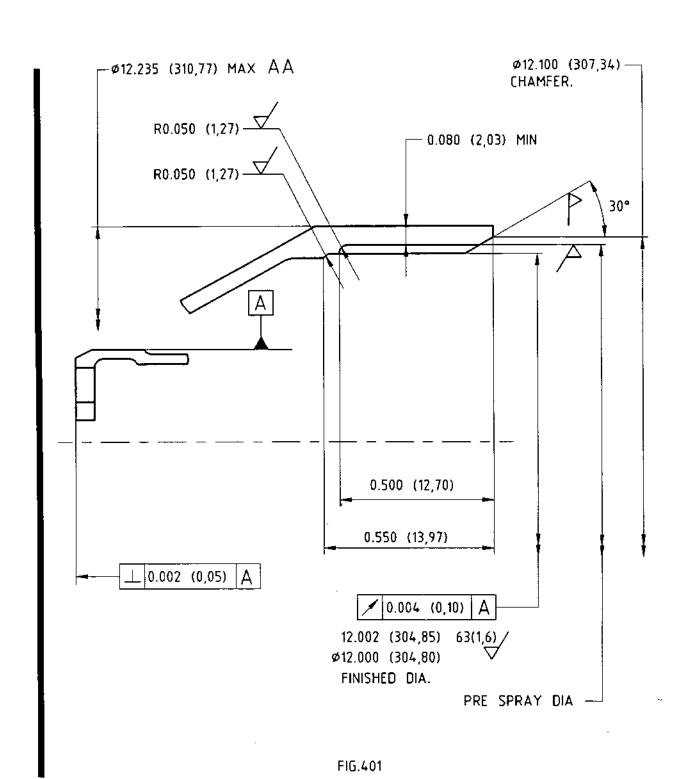
10) Visually inspect coating for defects.

Refer TSD 594 OP.704 section 8.

11) Mark Repair Instruction number RI B513509 or R32 on component adjacent to normal 'assy. of' no. using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

| 5. | <u>MATERIAL</u> | | | |
|----|------------------------------------|--------|---------------------|-------------|
| | COMPONENT | | MATERIAL . | RR CODE |
| | TUBE, ASSEMBLY OF AIR TRANSFER. | , | MSRR6503 JETHETE | EAK |
| 6. | DATA | | | |
| | NONE. | | | |
| 7. | TOOLS | | | |
| | TOOL NUMBER | DESCRI | PTION | ITEM |
| | \$3\$15334000 | MACHIN | ING FIXTURE | 1 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | DESCRI | PTION | <u>ITEM</u> |
| | NONE. | | | |
| | | | | |



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DISK, COMPRESSOR ROTOR, HP STAGE 3

PROVISION FOR RESTORATION OF FRONT AND REAR LOCATION DIAMETERS BY PLASMA SPRAYING.

B513817-18

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | Part No. |
|------------|--------------------------------|---|
| 72-33-02 | 1 /350D (POST MOD.8896 STD) | B509596 B509597 B512730 B512731 B512732 B512733 B512734 B512735 B512736 B512737 |
| | 1 /350E (POST MOD.8925 STD) | B512568 B512571 B512746 B512747 B512748 B512749 B512750 B512751 B512752 B512753 |
| | 1 /350F (POST MOD.9020 STD) | B517003 B517004 B517005 B517006 B517007 B517008 B517009 B517010 B517011 B517012 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

The maximum repairable diameter of the front location diameter is o20.318 (516,08). Refer fig.402.

The maximum repairable diameter of the rear location diameter is o20.498 (520,65). Refer fig.405.

Repair instructions B513817 and B513818, (operations 2 to 13), must not be applied simultaneously or a loss of datums will result.

Geometric tolerances and dimensions apply in the restrained state.

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

B513817: RESTORATION OF FRONT LOCATION DIAMETER.

<u>CAUTION:</u> During repair of this component its surfaces must be protected from corrosion at all times. Work to procedure detailed in Overhaul Manual Chapter 72-09-20 Repair using dewatering oil.

 Remove corrosion resistant coating. Refer Overhaul Manual Chapter 72-09-00 Cleaning using process F.

REPEAT REPAIRS ONLY.

2) Chemically strip existing coating.
NOTE: If rear location diagram

NOTÉ: If rear location diameter has previously been Plasma Sprayed, mask coated areas to prevent loss of Datum B.

Refer Overhaul Manual Chapter 72-09-25 Repair using process A. Refer fig.401.

Alternative: Existing coating may be removed by machining to Operations 4.4 and 4.5. Remove minimum parent material.

3) Locally swab etch repair area to ensure complete removal of coating. Proceed directly to Operation 7 (if satisfactory). Refer Overhaul Manual Chapter 72-09-14 Repair using solution E.

NEW ARISING

4) Locate component to a suitable machine and set true to Datums A and B.

Refer fig.401.

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| 5) | Machine the front location diameter. | Refer fig.402. Refer para.6A.DATA. |
|------|--|--|
| 6) | Remove component from machine. | |
| 7) | Dress to remove burrs and sharp edges. | Use hand tools only. |
| 8) | Dimensionally inspect. | Refer fig.402. |
| 9) | Magnetic particle inspect repair area. | Refer Overhaul Manual Chapter 72-33-02 Inspection/Check. |
| 10) | Mask off all areas not being coated. | Refer TSD 594 OP.704. Refer fig.404. |
| 11)~ | Plasma spray front location diameter over length AC to a minimum thickness of 0.015(0,38). | Refer TSD 594 OP.704. Use OMat 3/179. Refer fig.404. |
| 12) | Visually inspect coating for evidence of blistering, lifting, cracking or chipping. | Refer TSD 594 OP.704. |
| 13) | Remove masking. | |
| 14) | Locate component to a suitable machine and set true to Datums A and B. | Refer fig.401. |
| 15) | Finish machine the front location diameter to the post spray dimensions. | Refer fig.403. Refer para.6B.DATA. |
| 16) | Remove component from machine. | |
| 17) | Dress to remove burrs, sharp edges and any surplus spray. | Use hand tools only. |
| 18) | Visually inspect coating for evidence of blistering, lifting, cracking or chipping. | Refer TSD 594 OP.704. |
| 19) | Dimensionally inspect. | Refer fig.403. |
| 20) | Magnetic particle inspection. | Refer Overhaul Manual Chapter 72-33-02 Inspection/Check. |

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21) Mark Repair Instruction number RI B513817 or R33A and coating identity symbol on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer fig.409 for identity marking location.

Coating symbol



NOTE: At this point Mod.72-9020 must be effected to post Mod.72-8925 components and to post Mod.72-8896 components if required. Re-part number accordingly. If Mod.72-9020 is not effected to post Mod.72-8896 components, complete repair to B513818 Operations 22 to 25. For post Mod.72-9020 components, complete repair to B513818 Operations 26 to 30.

B513818: RESTORATION OF REAR LOCATION DIAMETER.

Remove corrosion resistant coating.

Refer Overhaul Manual Chapter 72-09-00 Cleaning using process F.

REPEAT REPAIRS ONLY.

2) Chemically strip existing coating.

NOTE: If front location diameter has previously been Plasma Sprayed, mask coated areas to prevent loss of Datum C.

Refer Overhaul Manual Chapter 72-09-25 Repair using process A. Refer fig.401.

Alternative: Existing coating may be removed by machining to Operations 4.4 and 4.5. Remove minimum parent material.

3) Locally swab etch repair area to ensure complete removal of coating. Proceed directly to Operation 7 (if satisfactory). Refer Overhaul Manual Chapter 72-09-14 Repair using solution E.

NEW ARISING

4) Locate component to a suitable machine and set true to Datums A and C.

Refer fig. 401.

5) Machine the rear location diameter.

Refer fig.405. Refer para.6A.DATA.

REPAIR
72-33-02
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20)

Magnetic particle inspection.



| | | RÔTCE OVERHAUL | snecma - |
|-----|---|------------------------------------|--|
| 6) | Remove componen | it from machine. | |
| 7) | Dress to remove sharp edges. | burrs and | Use hand tools only. |
| 8) | Dimensionally i | nspect. | Refer fig.405. |
| 9) | Magnetic partic repair area. | le inspect | Refer Overhaul Manual Chapter 72-33-02 Inspection/Check. |
| 10) | Mask off all ar coated. | eas not being | Refer TSD 594 OP.704. Refer fig.404. |
| | Plasma spray re diameter over la minimum thick 0.015(0,38). | ength AB to | Refer TSD 594 OP.704. Use OMat 3/179. Refer fig.404. |
| 12) | | stering, lifting, | Refer TSD 594 OP.704. |
| 13) | Remove masking. | | |
| 14) | | it to a suitable true to Datums | Refer fig.401. |
| 15) | | er to the post | Refer fig.406. Refer para.6B.DATA. |
| 16) | Remove componen | at from machine. | |
| 17) | Dress to remove edges and any s | | Use hand tools only. |
| 18) | Visually inspec evidence of bli cracking or chi | stering, lifting, | Refer TSD 594 OP.704. |
| 19) | Dimensionally i | nspect. | Refer fig.406. |

Refer Overhaul Manual

Chapter 72-33-02 Inspection/Check.



21) Mark Repair Instruction number RI B513818 or R33B and coating identity symbol on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer fig.409 for identity marking location.

Coating symbol (HA



NOTE: At this point Mod.72-9020 must be effected to post Mod.72-8925 components and to post Mod.72-8896 components if required. Re-part number accordingly. If Mod.72-9020 is not effected to post Mod.72-8896 components, complete repair to Operations 22 to 25. For post Mod.72-9020 components, complete repair to Operations 26 to 30.

22) Perust to remove all corrosion products.

NOTE: This procedure to be completed not more than 24 hours before painting.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use Process H.

23) Apply corrosion resistant coating all over except bolt holes, spigot diameters and blade slots and hatched areas marked AG.

NOTE: Identification numbers to remain visible after application of coating.

Refer figs.407, 408 and 409. Refer TSD 594 OP.349. Use OMat 7/46. Use Type A stoved at 515°C, or Type B coating.

24) Apply corrosion resistant sealing coating on the top of the corrosion resistant coating.

NOTE: Areas AH are to be brush touched up on assembly.

Refer figs.407, 408 and 409. Refer TSD 549 OP.349. Use OMat 7/168. Use OMat 7/22 (touch up).

25) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.

FOR POST MOD. 72-9020 COMPONENTS ONLY.

26) Derust to remove all corrosion products.
NOTE: This procedure to be completed not more than 24 hours before painting.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use Process H.

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27) Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots (over areas marked AK) and hatched areas marked AG.

NOTE: Identification numbers to remain visible after application of coating.

Refer figs.407, 408, 409 and 410.
Refer TSD 594 OP.349.
Use OMat 7/46.
Use Type A stoved at 515°C, or Type B coating.

28) Apply corrosion resistant seal coating on top of the corrosion resistant coating.

NOTE: Areas AH are to be brush touched up on assembly.

Refer figs.407, 408, 409 and 410. Refer TSD 594 OP.349. Use OMat 7/168. Use OMat 7/22 (touch up).

29) Inspect fir tree root to blade clearance.

Use blade root gauge or master top limit blade. Refer para 7. TOOLS item 1.

- 30) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.
- 5. MATERIAL

COMPONENT

MATERIAL

RR CODE

DISK, COMPRESSOR ROTOR, HP STAGE 3.

MSRR 6519 FV 535 EBH

6. DATA

A. PRE-COATING MACHINING.

Tool: Carbide ISO k10/k20 Lubricant: G.P soluble oil

Speed: 32 RPM.

Feed: 0.006 (0,15) hand.

B. POST-COATING MACHINING.

TOOL: ISO K range.

LUBRICANT: G.P soluble oil.

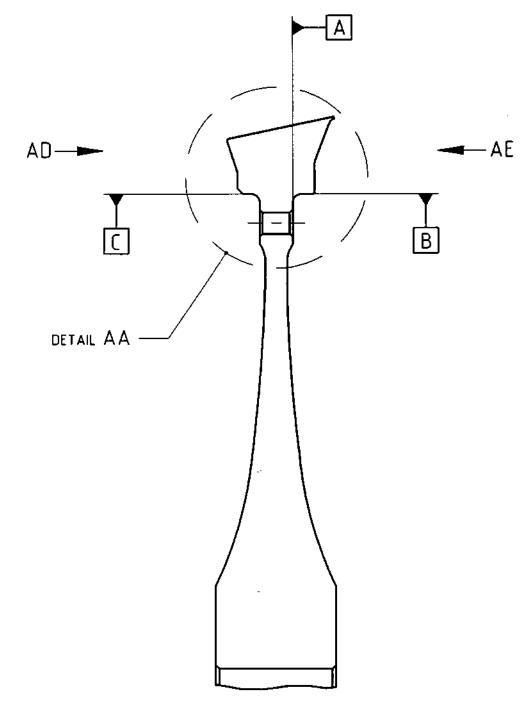
SPEED: 33 to 38 RPM.

FEED: Manual.

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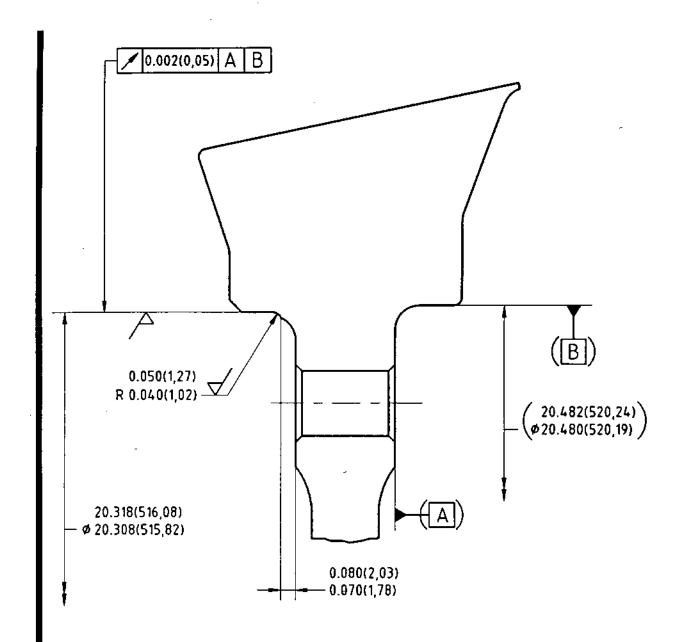


| 7. | TOOLS | | | |
|----|-------------------|--------------------|----------|-------------|
| | TOOL NUMBER | DESCRIPTION | | <u>ITEM</u> |
| | \$3\$14926000 | GAUGE | | 1 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | <u>DESCRIPTION</u> | QUANTITY | ITEM |
| | NONE. | | | |



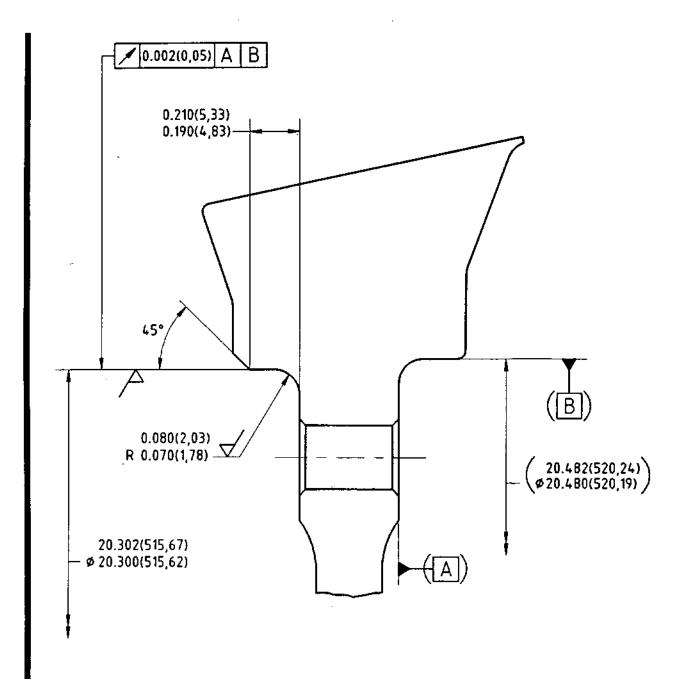
TYPICAL SECTION THROUGH DISK FIG.401.

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DETAIL AA
SHOWING THE PRE-SPRAY MACHINING DIMENSIONS
FOR THE FRONT LOCATION DIAMETER.
FIG. 402.

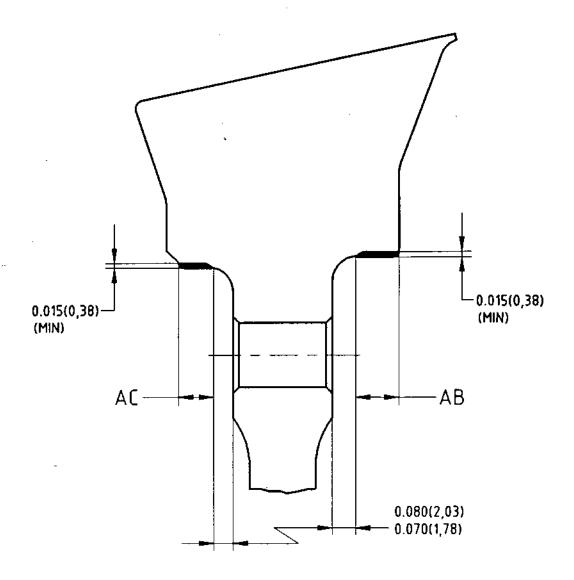
REPAIR
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DETAIL AA
SHOWING THE FINAL MACHINING DIMENSIONS
FOR THE FRONT LOCATION DIAMETER.
FIG.403.

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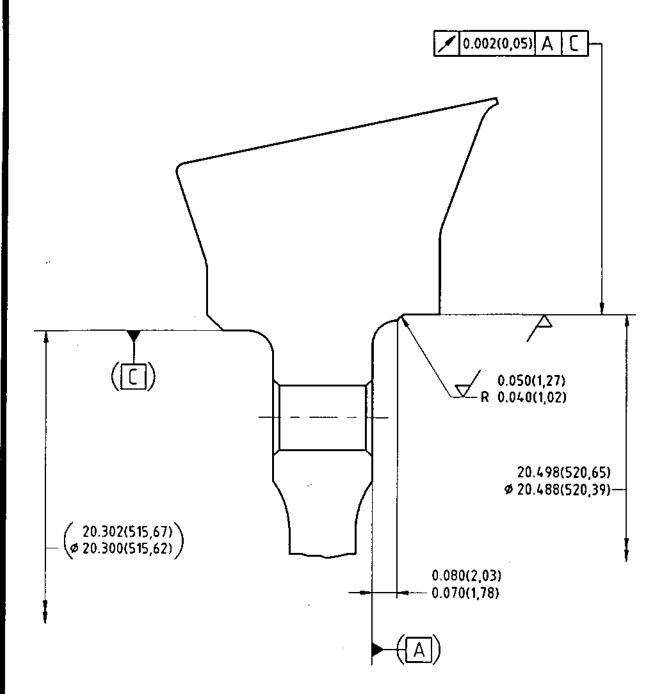




PLASMA SPRAY AREAS WITHIN AB AND AC NB. OVERSPRAY IS NOT PERMISSIBLE OUTSIDE OF DIMENSIONS SHOWN.

DETAIL AA
SHOWING AREAS OF PLASMA SPRAY APPLICATION
FIG.404.

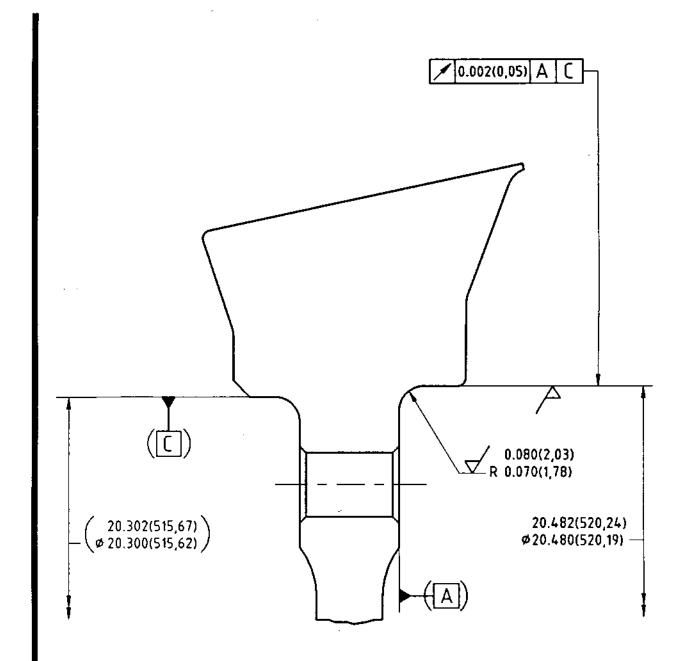
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DETAIL AA
SHOWING THE PRE-SPRAY MACHINING DIMENSIONS
FOR THE REAR LOCATION DIAMETER.
FIG.405.

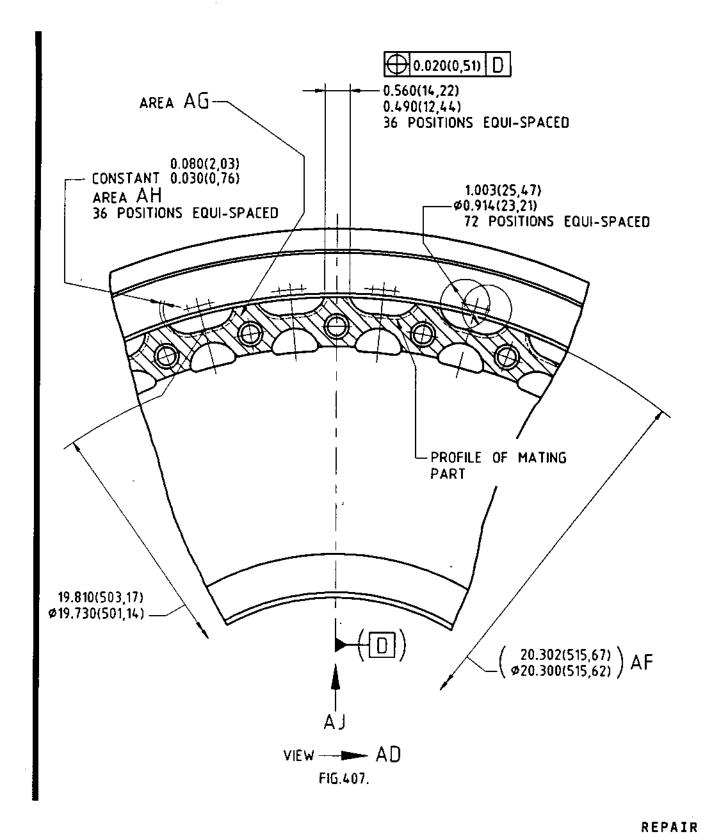
REPAIR
72-33-02
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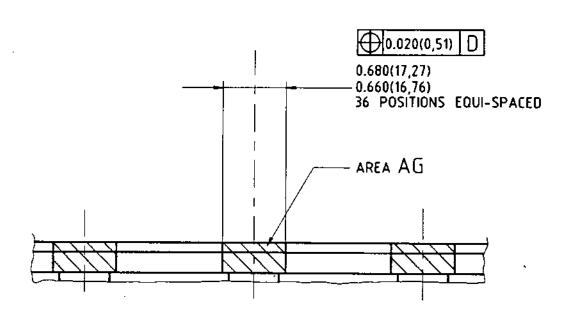
DETAIL AA SHOWING THE FINAL MACHINING DIMENSIONS FOR THE REAR LOCATION DIAMETER. FIG.406.

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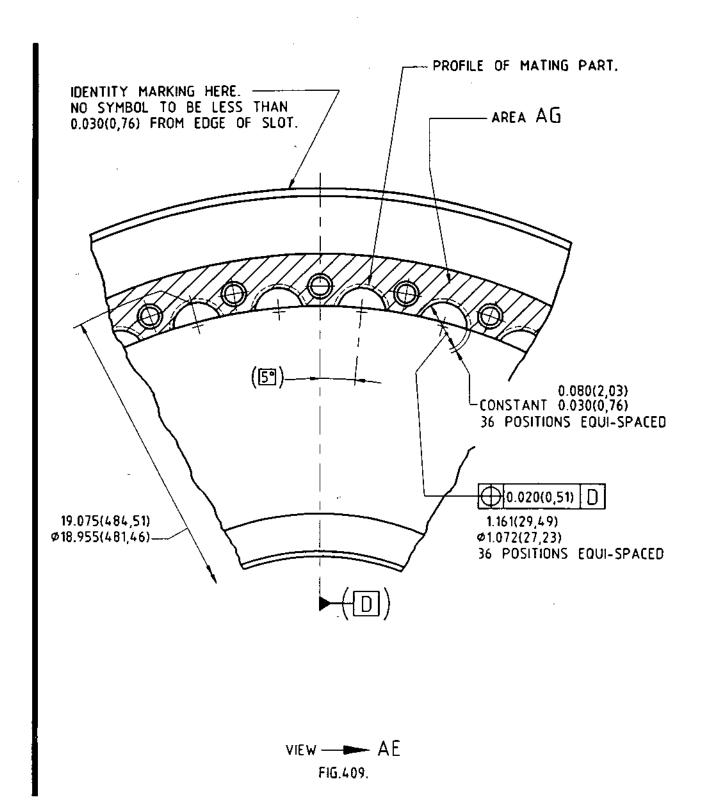
72-33-02
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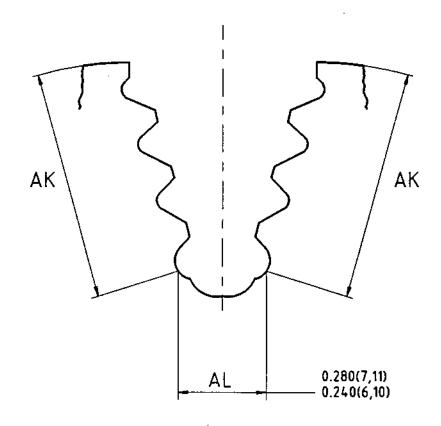


DEVELOPED V — AJ ON DIAMETER AF FIG. 408.

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NOTE: AREA AL TO COVER TOTAL LENGTH OF SLOT.

NO OVERSPRAY IS PERMITTED ON THE
FIR-TREE SLOT AREAS MARKED AK PROTECTIVE
COATING MAY BE BRUSH APPLIED PROVIDED THAT
EVEN COVERAGE AND 'WETTING' IS OBTAINED.

TYPICAL VIEW ON FIR TREE ROOT SLOT SHOWING AREA OF PROTECTIVE COATING FIG.410

> REPAIR 72-33-02 Repair No. 33 Page 418 Jun 1/96



HP COMPRESSOR RING SPACER STAGE 4-5 - REPAIR RESTORATION OF FRONT AND REAR LOCATION DIAMETERS BY PLASMA SPRAYING

MODIFICATION NO. OL.8959

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u>
72-33-02 2 50A 8922843
8922844

2. Introduction

A. General.

- (1) This repair describes the procedure for the restoration, by plasma spraying, of the front and rear location diameters of the H.P. Compressor fourth and fifth stage spacer ring.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on angles are plug/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

(1) Compliance with all aspects of these repair processes should be achieved without deviation. Where a need to deviate is considered to be necessary agreement should first be sought from the Repair Authority.

CAUTION: REPAIRS TO THE FRONT LOCATION DIAMETER AND THE REAR LOCATION DIAMETER ARE ONLY TO BE CARRIED OUT INDIVIDUALLY. THEY MUST NOT BE CARRIED OUT TOGETHER OR A LOSS OF DATUMS WILL RESULT.

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- (2) The minimum repairable diameter of the front location diameter is 22.289 in. (566,14 mm). (Refer to Figure 401).
- The minimum repairable diameter of the rear location (3) diameter is 23.631 in. (600,23 mm). (Refer to Figure 404).
- Geometric tolerances and dimensions apply in the restrained state.

3. Instructions

- Restoration of Front Location Diameter.
 - (1) Preparation.
 - Refer to Figure 401. Mount the spacer ring in a (a) lathe and set true to datums B and C.
 - (2) Machine.
 - Machine the front location diameter using the (a) following parameters:

Tool:

Carbide ISO k05/k10.

Lubricant:

GP Soluble oil.

Speed:

12.5 RPM.

Feed:

0.004 in. (0,1 mm)/REV. Depth of cut: 0.006 in. (0,15 mm).

- (3) Inspect.
 - (a) Refer to Figure 401. Check dimensions of machined areas.
 - **(b)** Carry out crack detection of the machined area using the fluorescent dye penetrant method specified for this component in Chapter 72-33-02, Inspection/Check.
- (4) Plasma Spray.
 - Refer to Figure 403 and Chapter 72-09-11, Repair. Mask off the area not to be plasma sprayed.
 - (b) Plasma spray the front location diameter over length AB to a minimum thickness of 0.015 in. (0,38 mm) using MSRR 9507/35 (Metco 447 NS).

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- (5) Inspect.
 - Refer to Chapter 72-09-11, Repair. Visually inspect the coating for defects.
- (6) Post Spray Machine.
 - (a) Refer to Figure 402. Mount the component in a lathe and set true to datums B and C.
 - Machine the front location diameter to the post-(b) spray diameters using the following parameters:

Tool:

ISO k range. Lubricant: GP Soluble oil.

Speed:

25-30 RPM.

Feed:

Manual.

- (7) Inspect.
 - Referring to Figure 402. Check dimensions of machined area.
 - Refer to Chapter 72-09-11, Repair. Visually inspect the machined area for defects.
- Identify. (8)
 - Mark the spacer ring SAL B513847 adjacent to the existing part number, and within the area AA, using vibro-percussion method specified in Chapter 72-09-00, Repair.
- Restoration of Rear Location Diameter.
 - (1) Preparation.
 - Mount the spacer ring in a Refer to Figure 404. lathe and set true to datums A and C.
 - Machine. (2)
 - Machine the rear location diameter using the following parameters:

Tool:

ISO k05/k10.

Lubricant:

GP Soluble oil.

Speed:

12.5 RPM.

Feed: 0.004 in. (0,1 mm)/REV.-Depth of cut: 0.006 in. (0,15 mm).

REPAIR

- (3) Inspect.
 - (a) Refer to Figure 404. Check dimensions of machined area.
 - (b) Carry out crack detection of the machined area using the fluorescent dye penetrant method specified for this component in Chapter 72-33-02, Inspection/Check.
- (4) Plasma Spray.
 - (a) Refer to Figure 403 and Chapter 72-09-11, Repair.
 Mask off the area not to be plasma sprayed.
 - (b) Plasma spray the rear location diameter over length AC to a minimum thickness of 0.015 in. (0,38 mm) using MSRR 9507/35 (Metco 447 NS).
- (5) Inspect.
 - (a) Refer to Chapter 72-09-11, Repair. Visually inspect the coating for defects.
- (6) Post Spray Machine.
 - (a) Refer to Figure 405. Mount the component in a lathe and set true to datums A and C.
 - (b) Machine the rear location diameter to the postspray diameter using the following parameters:

Tool: ISO k range. Lubricant: GP Soluble oil.

Speed: 25-30 RPM. Feed: Manual.

- (7) Inspect.
 - (a) Refer to Figure 405. Check dimensions of machined area.
 - (b) Refer to Chapter 72-09-11, Repair. Visually inspect the machined area for defects.

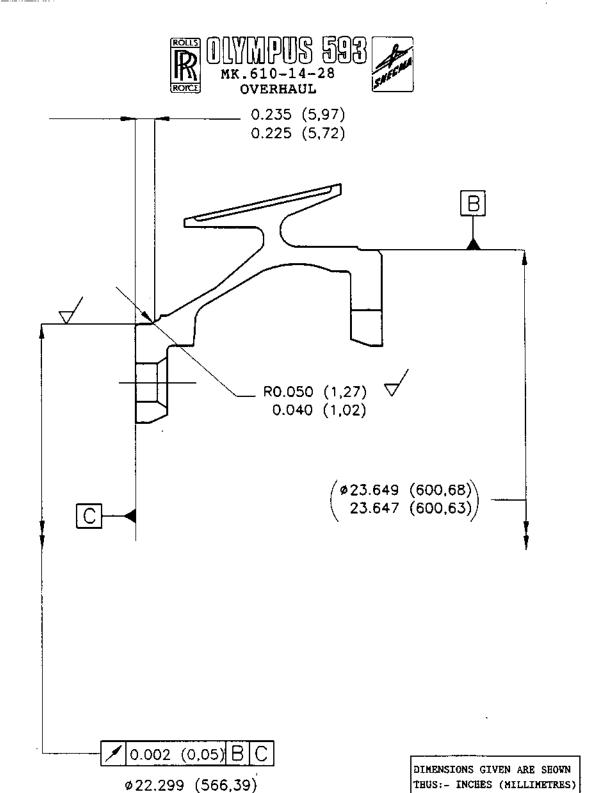
REPAIR 72-33-02 Repair No.34 Page 404 Dec 1/96



- (8) Identify.
 - (a) Mark the spacer ring SAL B513848

 adjacent to the existing part number, and within the area AA, using vibro-percussion method specified in Chapter 72-09-00, Repair.
- C. Final Inspection.
 - (1) Finally inspect to ensure that the repair has been carried out satisfactorily and the spacer ring is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment
 None.
- 5. Replacement Parts

None.



VIEW SHOWING PRE SPRAY MACHINING DIMENSIONS FOR FRONT LOCATION DIAMETER.

22.289 (566,14)

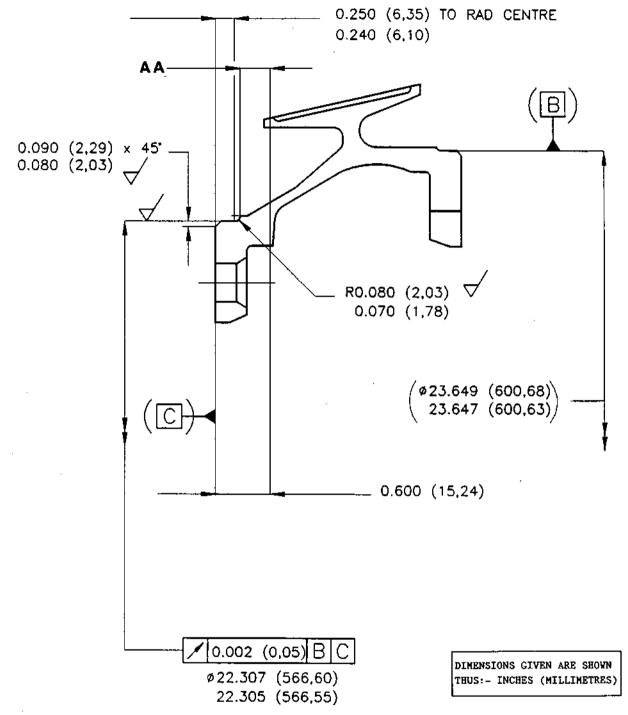
Front Diameter Pre Spray Machining Dimensions Figure 401

REPAIR

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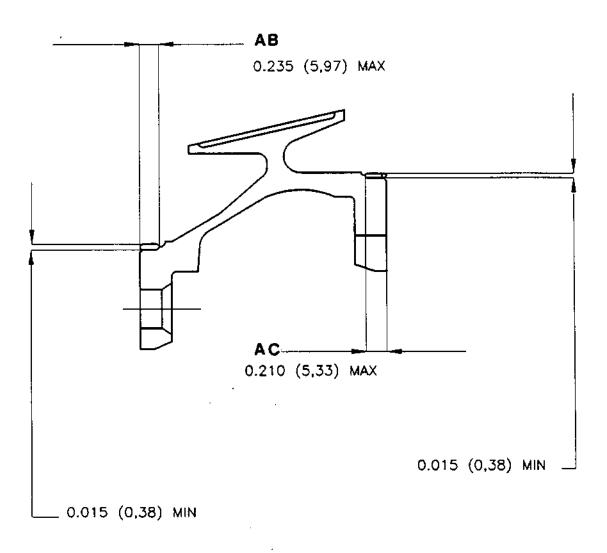
VIEW SHOWING FINAL MACHINING DIMENSIONS FOR FRONT LOCATION DIAMETER.

Front Diameter Final Machining Dimensions Figure 402

REPAIR

72-33-02

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DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

NOTE: OVERSPRAY IS NOT PERMISSIBLE OUTSIDE OF THE DIMENSIONS SHOWN.

PLASMA SPRAY AREAS WITHIN AB AND AC.

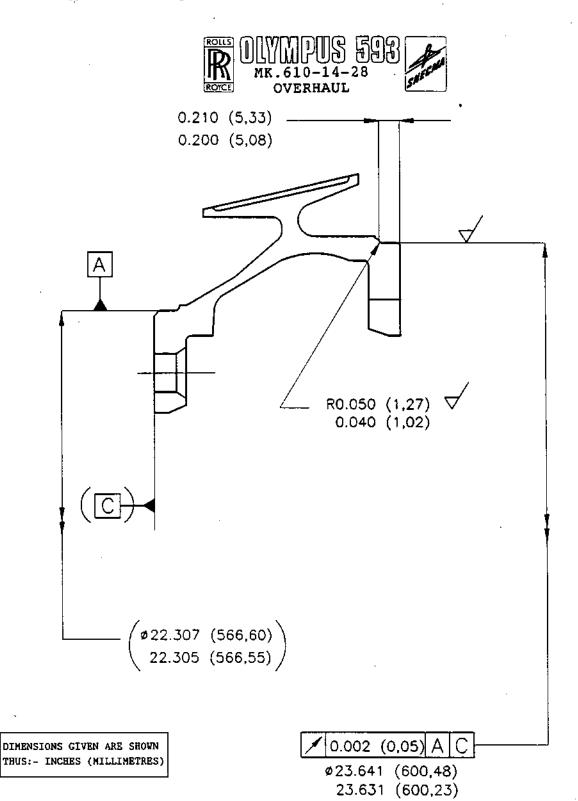
VIEW SHOWING AREAS OF PLASMA SPRAY APPLICATION.

Front and Rear Diameter Spray Dimensions Figure 403

REPAIR

72-33-02

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VIEW SHOWING PRE SPRAY MACHINING DIMENSIONS FOR REAR LOCATION DIAMETER.

Rear Diameter Pre Spray Machining Dimensions Figure 404

REPAIR

72-33-02

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0.225 (5,71) TO RAD CENTRE 0.215 (5,46) 0.090 (2,29) x 45° ∇ 0.080 (2,03) AA R0.080 (2,03) 0.070 (1,78) ____ 0.600 (15,24) \$\psi 22.307 (566,60) \rightarrow\$ 22.305 (566,55) 0.002 (0,05) A ø23.649 (600,68) DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES) 23.647 (600,63)

VIEW SHOWING FINAL MACHINING DIMENSIONS FOR REAR LOCATION DIAMETER.

Rear Diameter Final Machining Dimensions Figure 405

REPAIR

72-33-02

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HP COMPRESSOR ROTOR - STAGE 4 TO 5 SPACER RING - REMOVAL OF CORROSION AND BLENDING OF DAMAGE

MODIFICATION NO.OL.8945C

1. Effectivity

<u>IPC</u> <u>Fig./Item</u> <u>Part No.</u> 72-33-02 2 50 B922843, B922844

2. Introduction

A. General

CAUTION: COMPLIANCE WITH ALL ASPECTS OF THIS REPAIR PROCESS SHOULD BE ACHIEVED WITHOUT DEVIATION. WHERE DEVIATION IS CONSIDERED NECESSARY, REFERENCE MUST BE MADE TO THE REPAIR AUTHORITY FOR AGREEMENT.

- (1) This repair describes the procedure for removal of corrosion and blending corrosion damage on the stage 4-5 spacer ring inner surfaces and bolt-holes.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 63 micro-inches (1,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations (Ref.72-09-20 Repair).

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B. Repair Limitations

- (1) Bolt-holes AA (Ref. Fig. 401).
 - (a) Corrosion must be less than 0.004 in. (0,10 mm) deep and less than 50% of hole circumference.
 - (b) Maximum blend depth is 0.005 in. (0,13 mm).
- (2) Inner diameter AC (Ref. Fig. 401).
 - (a) Corrosion must be less than 0.008 in. (0.20 mm) deep.
 - (b) Maximum blend depth is 0.010 in. (0,25 mm).
 - (c) Minimum wall section is 0.140 in. (3,56 mm).
- (3) For re-application of this repair, the total blend depth must not exceed the repair limitations.

3. <u>Instructions</u>

A. De-scale

(1) De-scale the spacer using cleaning process L (Method 1). For procedure, refer to Chapter 72-09-00 Cleaning.

B. Blend

(1) Blend to remove corrosion within repair limits using conventional hand tools, achieving a surface finish of 63 micro-inches (1,6 micrometres) with smooth and continuous blends.

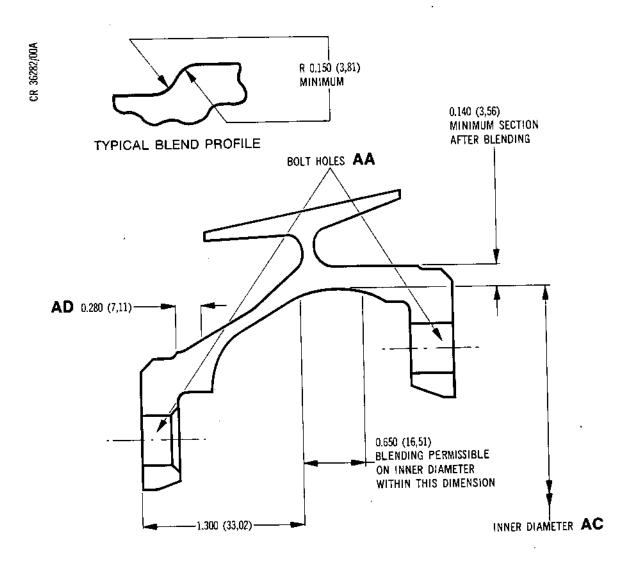
Power tools Ref. tool items 1 and 2 may be used, but only light pressure is to be applied to avoid local overheating.

NOTE: Signs of overloading are smoking and an unpleasant odour from the abrasive wheel adhesive.

C. Inspect

- (1) Visually inspect for the satisfactory removal of corrosion.
- (2) Locally etch the blended areas as instructed in Chapter 72-09-14 Repair, using etching solution C.

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TYPICAL SECTION THROUGH SPACER (TAKEN THROUGH BOLT HOLES)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

HP Compressor Spacer Stage 4-5 Figure 401

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- (3) Inspect the blended areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-33-02 Inspection/Check.
- D. Vapour Blast
 - (1) Vapour blast the blended areas as instructed in Chapter 72-09-13 Repair, using procedure B.
- E. Identify
 - (1) Mark SAL B512616 within area AD (Ref.Fig.401) adjacent to the existing part number, using vibro-percussion engraving as instructed in Chapter 72-09-00 Repair.
- F. Final Inspection.
 - (1) Finally inspect the spacer to ensure that the repair has been carried out satisfactorily and that the spacer is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Qty. | <u>Part No.</u> | <u>Item</u> |
|--------------------|------|-----------------------------|-------------|
| Pneumatic drill | 1 | USHIO MSG-3BSN 65000 rpm | 1 |
| Abrasive wheel | 1 | A120 HFX | 2 |

5. Replacement Parts

None.



RING, SPACER, STAGE 6-7 (HPC)

REMOVAL OF CORROSION FROM INNER SURFACES, REAR FLANGE FACES AND BOLT HOLES BY BLENDING/POLISHING

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|-------------------|------------------|--|
| 72 -33 -02 | 3 390A | B922851 B922852 B922853 B922854 B922855 B922856 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

REPAIR LIMITS (Refer fig. 401).

Bolt holes designated 'AB', with corrosion to a maximum depth of 0.002(0.05) for up to 50% of hole circumference, may be blended to a maximum depth of 0.003(0.08).

Bolt holes designated 'AC' and 'AD', with corrosion to a maximum depth of 0.004(0,10) for up to 50% of hole circumference, may be blended to a maximum depth of 0.005(0,13).

Inner diameter designated 'AE', with corrosion up to a maximum depth of 0.008(0,20) deep, may be blended up to a maximum depth of 0.010(0,25). Maintain minimum wall section of 0.183(4,65).

For re-application of this Repair Instruction the total blend depth shall not exceed the limits stated above.

Rear flange faces designated 'AF', with corrosion up to 0.002 (0,05) deep, are acceptable for repair. Residual corrosion pitting is acceptable after de-scaling and light polishing.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees

REPAIR

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Break sharp edges 0.004 to 0.020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 63 (1,6) Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

De-scale to remove corrosion. 1)

Refer Overhaul Manual Chapter 72-09-00, Cleaning Process L.

2) Bolt holes AB, AC, AD and inner diameter AE.

> Using hand tools only, blend to remove corrosion and achieve a surface finish of 63 microinches (1,6 micrometres). Blends to be smooth and continuous.

Refer fig. 401. Refer Para.2, Repair limits.

Rear flange faces AF.

Lightly polish using abrasive mat Use OMat 583 or 5/44 or fine grade abrasive papers/

(typical).

- 3) Visually inspect for removal of corrosion deposits.
- 4) Locally etch repaired areas

Refer Overhaul Manual Chapter 72-09-14, Repair, Solution C.

Crack detect repaired areas. 5)

Refer Overhaul Manual Chapter 72-33-02, Inspection/Check).

Vapour blast repaired areas.

Refer Overhaul Manual Chapter 72-09-13, Repair Procedure B.

7) Finally visually inspect spacer to ensure the repair has been carried out satisfactorily and that the spacer is in a serviceable condition.

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8) Mark Repair Instruction number R.I. B512617 or R36 adjacent to existing 'assy. of' number using the vibro-percussion engraving technique. Refer Overhaul Manual Chapter 72-09-00, Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

RING, SPACER, STAGE

WASPALOY

QDY

6-7 (HPC)

MSRR7034

6. DATA

THE DEFINITION OF THE TERM HAND TOOLS ONLY IS DEEMED TO IMPLY THAT THE FOLLOWING MAY BE USED:

GUN - USHIO AIR TOOL COMPANY LTD. TYPE MSG-3BSN 65,000 R.P.M. (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE TYPE A120 HFX.

THE AIRS WAS

LOAD/PRESSURE APPLIED WHEN USING THE ABOVE EQUIPMENT SHOULD NOT BE SUFFICIENTLY GREAT SO AS TO PRODUCE SMOKING AND/OR AN UNPLEASANT ODOUR FROM THE ABRASIVE

AGENT IN THE ABRASIVE WHEEL.

7. TOOLS

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

NOTE:

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

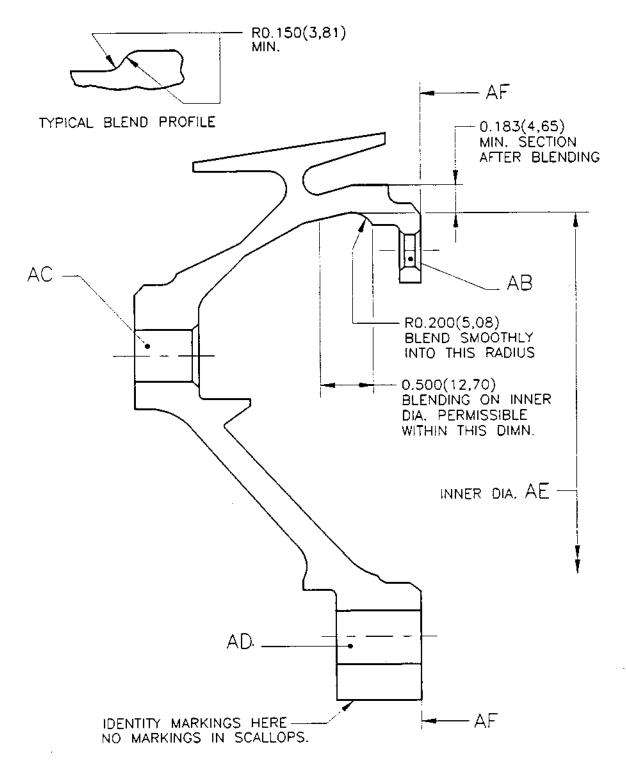
QUANTITY

ITEM

NONE.

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TYPICAL SECTION THRO' SPACER (TAKEN THRO' BOLT HOLES)
FIG. 401

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OVERHAUL

RING, SPACER, STAGES 3-4, 4-5, 5-6, 6-7 (H.P.C.)

RESTORATION OF ABRASIVE COATING ON OUTER DIAMETER

B513849-52

1. **EFFECTIVITY**

| <u>IPC</u> | <u>Fig.</u> | ./Item | <u>Part No.</u> |
|-------------------|-------------|--------|--------------------|
| 72 - 33-02 | 1 | 380A | в922839 |
| | _ | | B922840 |
| | 2 | 50A | B922843 B922844 |
| | 2 | 100A | B922847 |
| | | | B922848 |
| | 3 | 390A | B922851 |
| | | | B922852 |
| | | | B922853 |
| | | | B922854 |
| | | | B9 22855 |
| | | | B922856 |

Ζ. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED Drawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimetres) Tolerances on machined dimensions plus/minus 0.010 (0,25) Toterance on angles plus/minus 2 degrees Break sharp edges 0.004 to 0.020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 63 (1,6) Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Vapour Degrease. Refer Overhaul Manual Chapter 72-09-00 Cleaning.

Mask off all areas except area 2) marked AB.

Refer TSD 594 OP-104 Refer Fig. 401.

> REPAIR Repair No. 37

Page 401 Jan 31/95 3) Abrasive blast area AB to completely remove top coat of Abrasive coating only, leaving bond coat intact, indicated by colour change.

Refer Overhaul Manual Chapter 72-09-25 Repair, using Process K. Refer Fig. 401.

4) Apply bond coat to a thickness of 0.002/0.003 (0,05/0,076) to area AB.

Apply top coat to a thickness sufficient to produce final dimensions after machining.

Refer to TSD 594 OP.704
Refer Fig.401.
Use OMat 3/188 bond coat
and OMat 3/94 top coat.
Alternatively;
Use OMat 3/90 bond coat
and OMat 3/93 top coat.
Or Alternatively;
Use OMat 3/90 bond coat
and OMat 3/94 top coat.

- 5) Remove masking.
- 6) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.

Refer TSD 594 0P.704

7) Locate component to machine and set true to datums. Machine sprayed area AB to achieve required finished dimensions. Refer to Figs.401, 402, 403 404 or 405 (as required). Refer para.6. Data.

8) Dimensionally inspect.

Refer to Figs. 402, 403, 404 or 405 (as required).

9) Visually inspect coating for evidence of blistering, lifting, cracking or chipping. Refer TSD 594 OP.704 Refer Fig. 401.

10) Mark Repair Instruction number RI B513849-52 or R37A-D (see Table A) on component, adjacent to normal 'assembly of' number, using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.



MK.610-14-28 snecm OVERHAUL

TABLE A.

| SPACER | REPAIR | 'R' |
|--------|-------------|--------|
| RING | INSTRUCTION | NUMBER |
| STAGE | NUMBER | |
| 3-4 | B513849 | 37A |
| 4-5 | B513850 | 37B |
| 5-6 | B513851 | 37c |
| 6-7 | B513852 | 37D |

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

RING, SPACER, STAGES 3-4, 4-5, 5-6 AND 6-7

WASPALOY MSRR7034 QDY

(H.P.C.).

6. DATA

FINISH MACHINING DATA:-

TOOL

- STANDARD DIAMOND.

COOLANT

NONE. OBSERVE NECESSARY EXTRACTION REQUIREMENTS.

SPEED

- 31.5 R.P.M.

FEED

- 0.030ins.(0,76mm)/REV.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

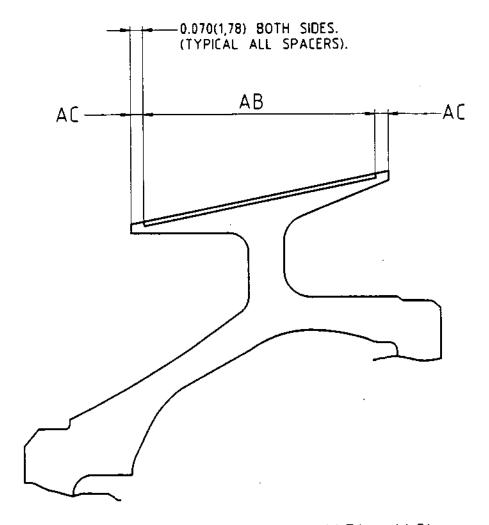
PART NUMBER

DESCRIPTION

QUANTITY

ITEM

NONE.



COATING IS ONLY PERMISSIBLE WHERE SHOWN 'AB' OR 'AC'

OVERSPRAY AT ANY OTHER AREA IS STRICTLY NOT PERMISSIBLE AND

MUST BE MASKED OFF TO PREVENT THIS.

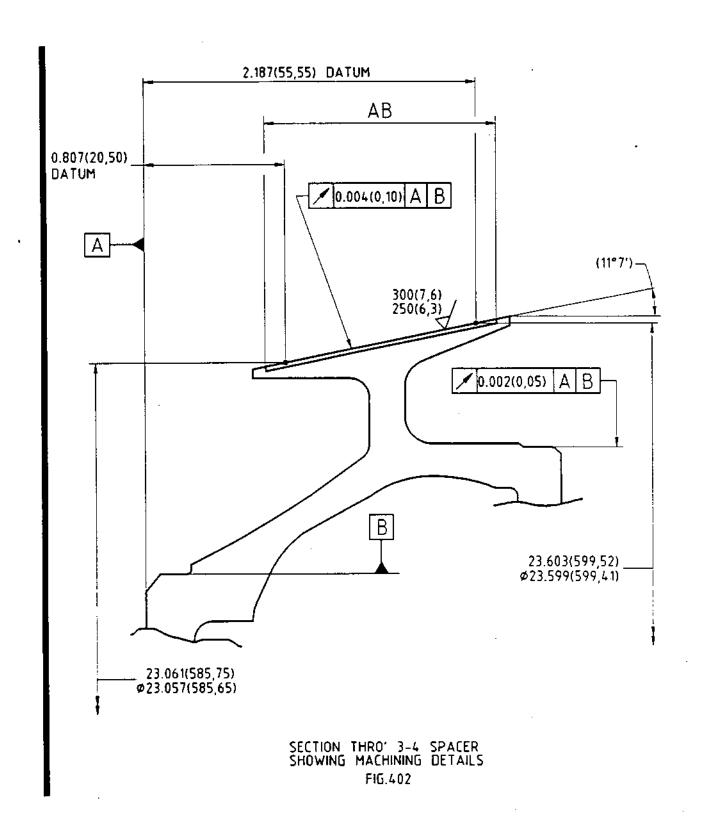
A WITNESS OF OVERSPRAY IS PERMISSIBLE AT AREA'S SHOWN 'AC'

PROVIDING IT IS SOUND AND SECURE.

FLAKING OR LOOSE COATING MUST BE COMPLETELY REMOVED

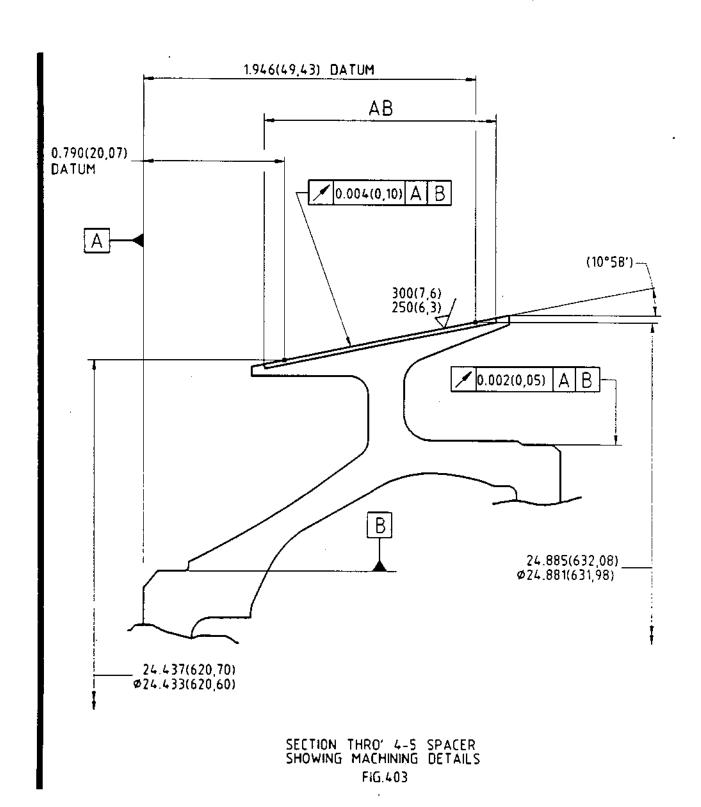
BY MACHINING.

TYPICAL SECTION THROUGH ALL SPACERS.
SHOWING COATING DETAILS
FIG.401

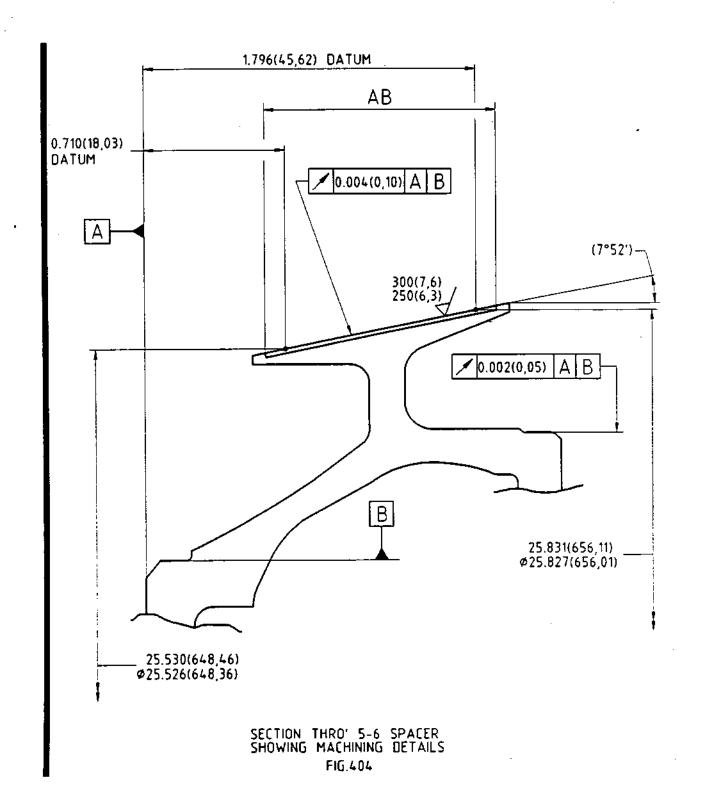
REPAIR 72-33-02 Repair No. 37 Page 404 Jan 31/95 

REPAIR Repair No. 37 Page 405 Jan 31/95



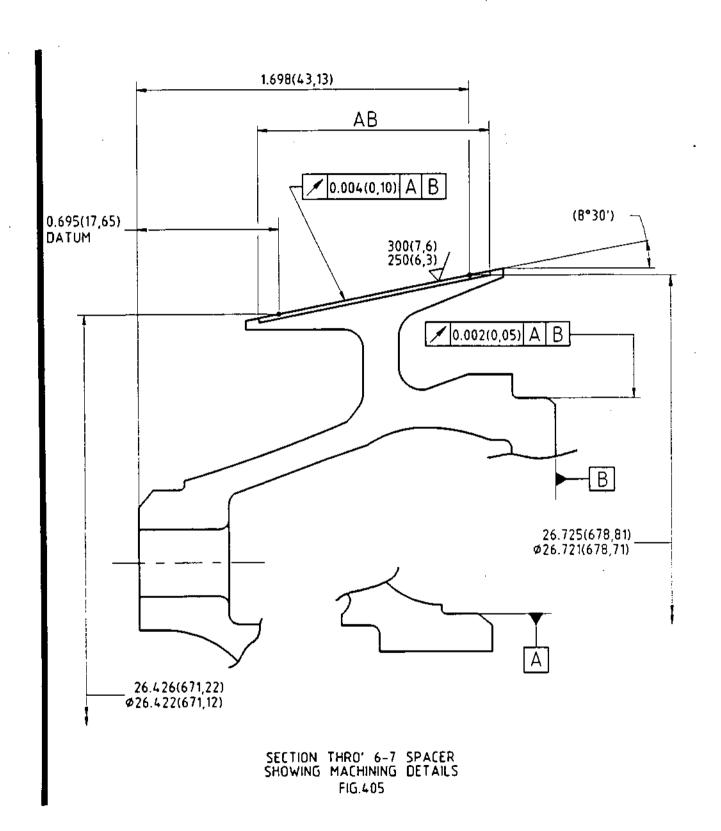


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72-33-02
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REPAIR 72-33-02 Repair No. 37 Page 408 Jan 31/95



SHAFT-ROTOR, FRONT, (H.P.C.)

STAGES 1-2 INTERSTAGE LABYRINTH FINS REBUILT BY MECHANISED T.I.G. ("DABBER") WELDING AND RE-MACHINED

| 1. | EFFECTIVITY | REPA | IR NO. B513351 | | |
|----|-------------|------|----------------|--|---|
| | IPC . | Fig. | /Item | Part | No. |
| | 72-33-02 | 01 | 260A | B922 B922 B922 B922 B922 | 640 905 906 907 |
| | | 01 | 2609 | B922 B927 B927 B927 B927 B927 B930 B930 B930 B930 B930 B930 B930 | 125 126 129 130 131 132 067 068 070 071 072 |
| | | 01 | 260c | 8930 8930 8930 8930 | 076 077 192 |
| | | | 2405 | 5547 | 7 . 0 |

01

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

260D

B513748 B513749

Minimum repairable diameter to which stages 1-2 Interstage labyrinth fins may be machined should not be les than 16.080 (408,432) diameter

REPAIR

72-33-02 Repair No. 38 Page 401 Dec 1/97 A test piece to the requirements of B513352 will be required initially and upon any subsequent change in Airline Operator, Subcontractor, Machine or Locality.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

Machine damaged fins within dimensions given. Hand blend to remove all burrs and sharp edges.

2) Crack detect machined

- 3) Build up fins using mechanised T.I.G. welding technique. Weld build-up must be sufficient to allow finish machining dimensions to be achieved. Allow part to cool for 10 to 15 minutes between each weld run.
- 4) Measure/Check to ensure that sufficient depth of weld has been deposited.

SUPPLEMENTARY INFORMATION

Refer figs. 401 & 402
Remove minimum amount of material to remove wear /damage.
Refer Para. 6. TOOLS item 1

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check

Refer TSD 594-409 Refer Para. 5 DATA Refer fig. 402 Refer Para 7. TOOLS items 2 and 3.

Refer Para 7. TOOLS item 3.

72-33-02 Repair No. 38 Page 402 Dec 1/91



| 5) | Crack detect repaired area | • · | Chapter | rerhaul Ma 72-33-02 on / Chec | |
|-----|---|-----------------------|---------------------------------|--------------------------------------|------------|
| 6) | Finish machine fins to Dimensions given. Remove burrs/sharp edges. | | Refer fi Refer Pa Item 1. | gs. 401 & ira 7. Too | 403 DLS |
| 7) | Dimensionally inspect. | | Refer fi | g. 403 | |
| 8) | Inspect for satisfactory completion of machining operation. | | | | |
| 9) | Swab etch areas affected b repair. | у | Chapter | verhaul Ma 72-09-14 Olution A. | Repair, |
| 10) | Crack detect repaired area | • | Chapter | /erhaul Ma 72-33-02 ion/Check | inual |
| 11) | Vapour blast areas affecte by repair. | d | Chapter | verhaul Ma 72-09-13 cedure B. | - |
| 12) | Mark SAL B513351 or R38 adjacent to existing part number using Vibro-percuss engraving. | ion | | /erhaul Ma 72-09-00 | |
| 5. | MATERIAL | | | | |
| | Component | Material | | RR Code | |
| | Shaft - rotor, front, (H.P.C.) | Titanium MSRR 8634 | | тст | |

or MSRR 8663

TGP



6. DATA

NOTE: All readings shown below are machine dial readings unless otherwise stated.

Mechanised T.I.G.welding

Material Titanium, MSRR 8634. Weld process Hobart Dabber Welder System. 400 D C. Weld current 100 Amps. Amperage Degrease using MEK. Weld preparation : Electrode specification : Material: 2% Thoriated Tungsten. Size: 0.0625 in. (1,6 mm) Dia. Argon. Shielding gas 35 cf/hr (991.5 L/h) Shielding gas flow rate : 7.6 Voltage (A.V.C.) : 4. Deadband Sensitivity 3. Lock out No. Retract distance 0 Starting arc gap Start delay Welding current:-Fusion mode Pendant setting, 20 Amps. 22 " Weld mode MSRR / 9500 / 70. Filler material spec 0.035 in.(0,89 mm) dia. Size Feed rate 6.4 IPM. (162,5 mm/min.) Filler wire start delay 2.0. : 0.1 Filler wire stop delay : 340. Dabber strokes / min. : Stroke length 0.236 in. (6.0 mm.) Pulsation No. Weld speed:-Fusion mode 7.875 ins/min. (200,0 mm/min.) 7.875 (200,0 Weld mode :

NOTES: Set table at 90°. Wire brush after each weld run. Use trailing shield on underside of fin location with FAS flow rate set at 35 cf. / h.

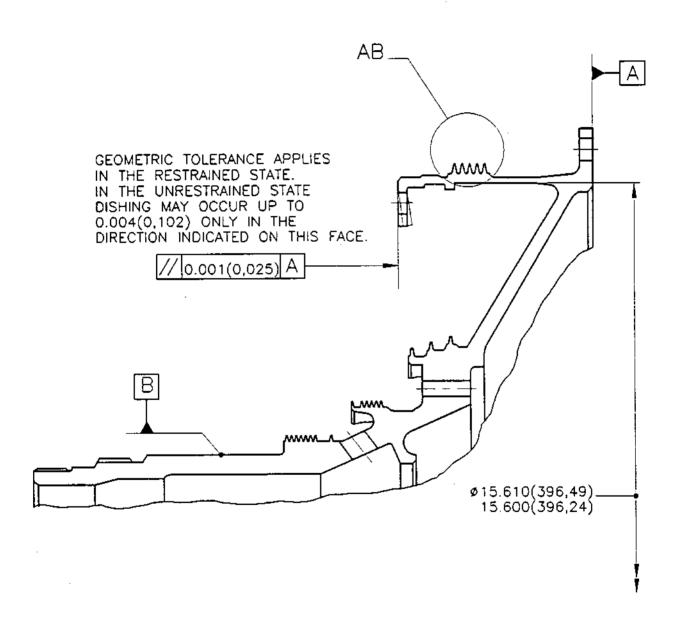


7. <u>TOOLS</u>

| Description | Tool No. | Item No. |
|--|----------------------------------|----------|
| Machining fixture. Welding fixture. | \$3\$ 15507000 \$3\$ 14406000 | 1. 2. |
| Template. | \$3\$ 14405000 | 3. |

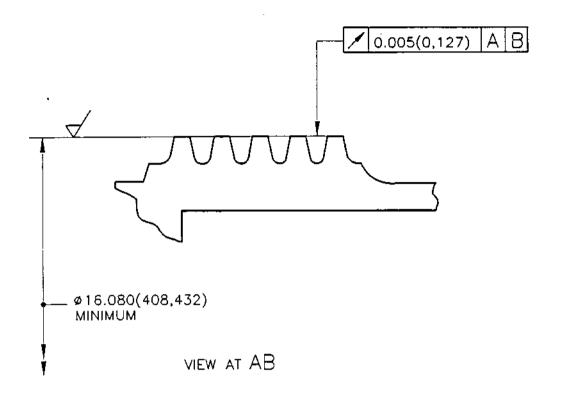
B. REPLACEMENT PARTS.

NONE



TYPICAL SECTION THROUGH SHAFT FIG.401

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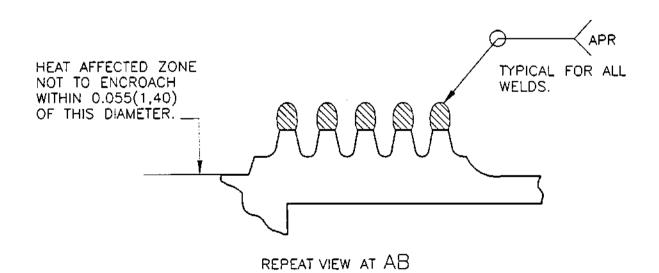
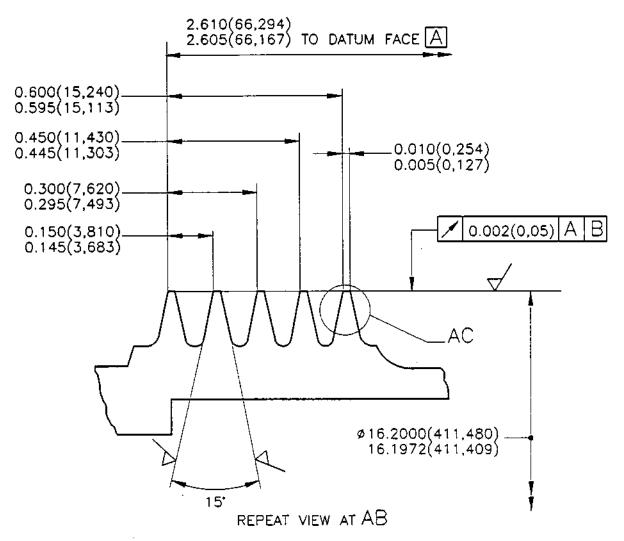
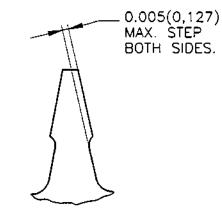


FIG.402

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VIEW AT AC APPLICABLE TO ALL FINS

FIG.403

72-33-02 Repair No. 38 Page 408 Dec 1/91



RING SPACER STAGE 6-7 (HPC)

PROVISION FOR RESTORATION OF FRONT AND REAR OUTER LOCATION DIAMETERS BY PLASMA SPRAYING.

REPAIR NO. B513857-58

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-33-02

03

390A

B922854

2. REPAIR LIMITATIONS.

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Repair instruction 8513857: Restoration of front outer location diameter.

The minimum repairable diameter of the front outer location diameter is 24.489 (622,02). (Ref fig 1 sht 6)

Repair instruction B513858: Restoration of rear outer location diameter.

The minimum repairable diameter of the rear outer location diameter is 25.700 (652,78). (Ref fig 1 sht 6)

Geometric tolerances and dimensions apply in the restrained state.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection



4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

B513857: Restoration of front outer location diameter.

 Set component in a lathe and set true to datums A and B. Machine the front location diameter. Refer fig 401
Machining data:
Tool: carbide k05/k10
Lubricant: G.P soluble oil
Speed: 12.5 RPM.
Feed: 0.004 (0,10)/REV.
Depth of cut: 0.006 (0,15)

2) Dimensionally inspect.

3) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-33-02 Inspection/check.

Refer fig 401

4) Mask off area not to be coated and spray front location diameter over length AB to a minimum thickness of 0.015 (0,38).

Refer fig 402 Refer TSD 594 OP 704. Use Metco 443 NS (MSRR 9507/14).

Visually inspect coating for defects. Refer TSD 594 OP 704 section 8.

6) Set component in a lathe and set true to datums A and B. Machine the front location diameter to the post spray diameter. Refer fig 403 Machining data. Tool: Iso K range Lubricant: G.P soluble oil Speed: 25-30 RPM Feed: manual.

7) Dimensionally inspect.

Refer fig 403

Visually inspect coating for defects.

Refer TSD 594 OP 704 section 8.

9) Mark on SAL B513857 or R39 and coating symbol HC adjacent to existing part number using vibro-percussion engraving. Refer Overhaul Manual Chapter 72-09-00 Repair.



B513858: Restoration of rear outer location diameter.

1) Set component in a lathe and set true to datums A and B. Machine the rear location diameter.

Refer fig 401 Machining data. Tool: k05/K10 Lubricant: G.P soluble oil Speed: 12.5 RPM. Feed: 0.004 (0,10)/REV.

Depth of cut: 0.006 (0,15)

- 2) Dimensionally inspect.
- 3) Crack detect repaired area.
- Refer Overhaul Manual Chapter 72-33-02 Inspection/check.

Refer fig 401

- 4) Mask off area not to be coated and spray rear location diameter over tength AC to a minimum thickness of 0.015 (0,38).
- 5) Visually inspect coating for defects.
- 6) Set component in a lathe and set true to datums A and B. Machine the location diameter to the postspray diameter.

- 7) Dimensionally inspect.
- 8) Visually inspect coating for defects
- Mark on SAL B513858 or R39 and coating symbol HC adjacent to existing part number using vibro-percussion engraving.

Refer fig 402 Ref TSD 594 OP 704.

Use Metco 443 NS

(MSRR 9507/14).

Ref TSD 594 OP 704. section 8.

Refer fig 403 Machining data. Tool: Iso K range Lubricant: G.P soluble oil Speed: 25-30 RPM Feed: manual.

Refer fig 403

Ref TSD 594 OP 704 section 8.

Refer Overhaul Manual Chapter 72-09-00 Repair



5. MATERIAL.

COMPONENT.

MATERIAL.

RR CODE

RING SPACER STAGE 6-7 (HPC)

MSRR 7034 Waspaloy QDY

6. DATA.

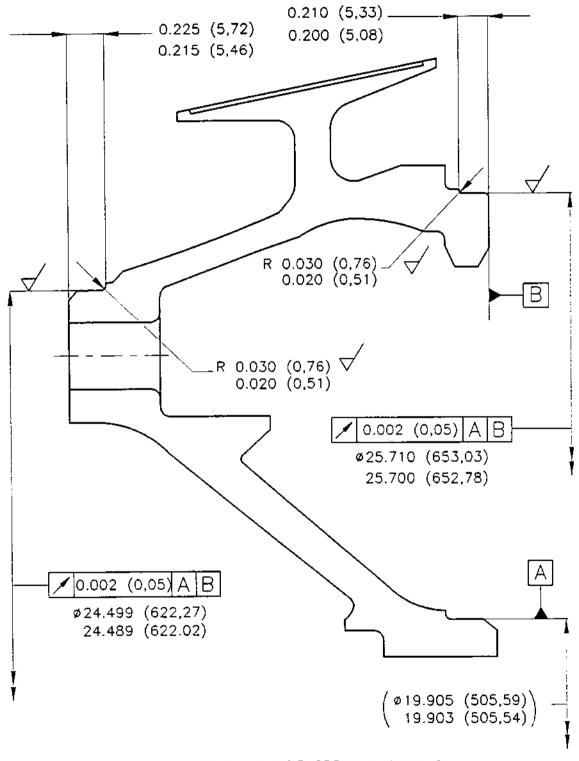
NONE.

7. <u>TOOLS.</u>

NONE.

8. REPLACEMENT PARTS.

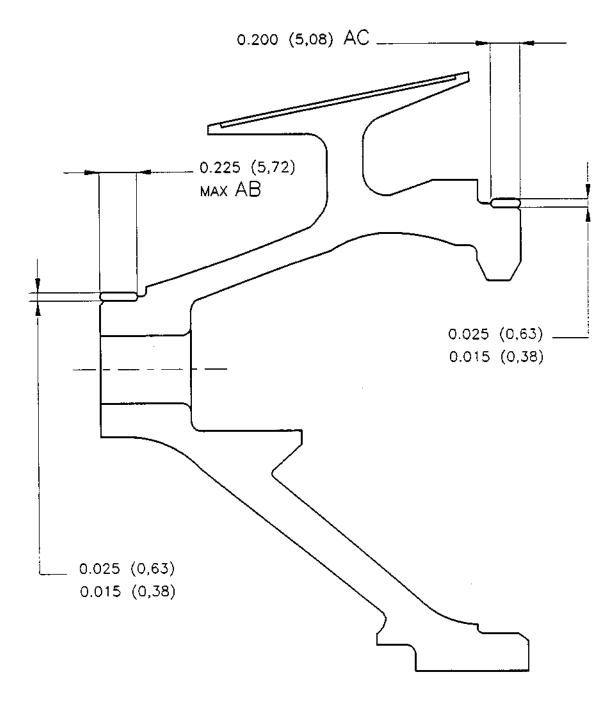
NONE



VIEW SHOWING PRE SPRAY MACHINING FIG.401

72-33-02 Repair No.39 Page 405 Dec 1/91

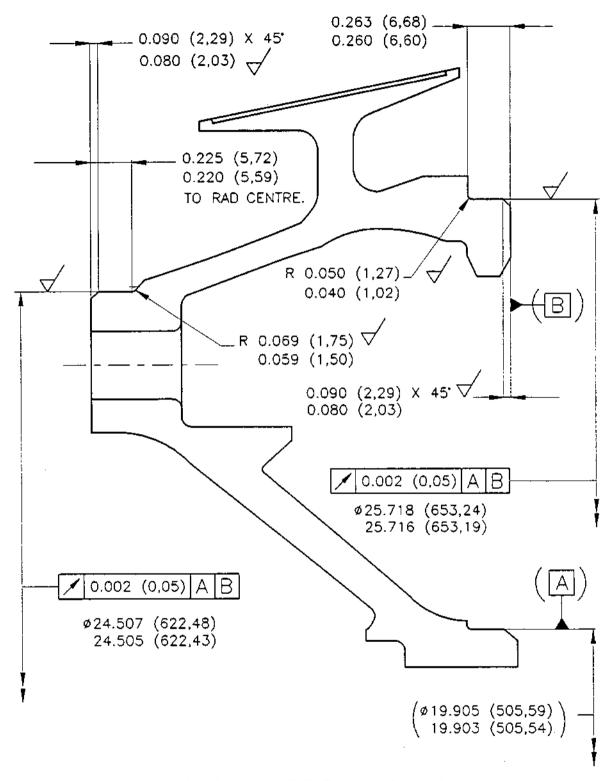




NOTE: OVERSPRAY IS NOT PERMISSIBLE OUTSIDE OF THE DIMENSIONS SHOWN.

VIEW SHOWING APPLICATION OF PLASMA SPRAY. FIG.402

72-33-02 Repair No.39 Page 406 Dec 1/91



VIEW SHOWING THE FINAL MACHINING FIG.403

72-33-02 Repair No.39 Page 407 Dec 1/91



RING SPACER STAGE 6-7 (HPC)

PROVISION FOR RESTORATION OF THE REAR INNER LOCATION DIAMETER BY PLASMA SPRAYING.

REPAIR NO. 8513859

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-33-02

03 390A

B922854

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

The minimum repairable diameter of the rear inner location diameter is 19.887 (505,13). (Ref fig 1 sht 4)

Geometric tolerances and dimensions apply in the restrained state.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Set component in a lathe and set true to datums A and B. Machine the rear inner location diameter. Refer fig 401
Machining data:
Tool: Carbide K05/K10
Lubricant: G.P soluble oil
Speed: 12.5 RPM
Feed: 0.004(0,10)/Rev.
Depth of cut: 0.006(0,15)

REPAIR 72-33-02 Repair No.40 Page 401 Dec 1/91



2) Dimensionally inspect.

Refer fig 401

3) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-33-02 (Inspection/check).

4) Mask off area not to be coated and spray rear location diameter over length AB to a minimum thickness of 0.015 (0,38).

Refer fig 402 Refer TSD 594 OP 704 Use Metco 443 NS (MSRR 9507/14).

5) Visually inspect coating for defects.

Refer TSD 594 OP 704 section 8.

6) Set component in a lathe and set true to datums A and B. Machine the rear location diameter to the post spray diameter. Refer fig 403
Machining data:
Tool: ISO K range
Lubricant: G.P soluble oil
Speed: 25-30 RPM
Feed: Manual

7) Dimensionally inspect.

Refer fig 403

Visually inspect coating for defects.

Refer TSD 594 OP 704 section 8.

9) Mark on SAL B513859 or R4D and coating symbol HC adjacent to existing part number. Vibro-percussion engrave in accordance with 72-09-00 (repair).

5. MATERIAL

COMPONENT.

MATERIAL.

RR CODE

RING SPACER STAGE 6-7 (HPC)

MSRR 7034 WASPALOY

QDY

6. DATA

None

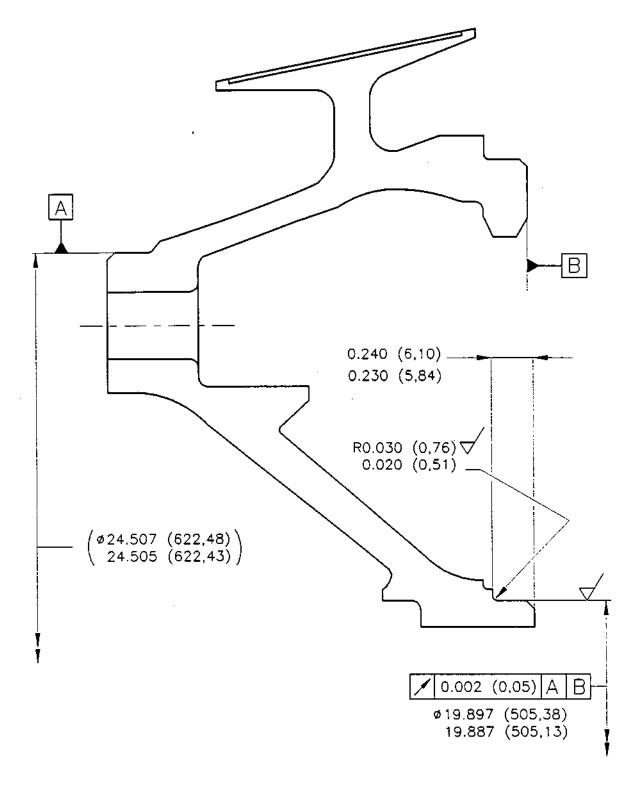
7. TOOLS

None

8) REPLACEMENT PARTS

NONE

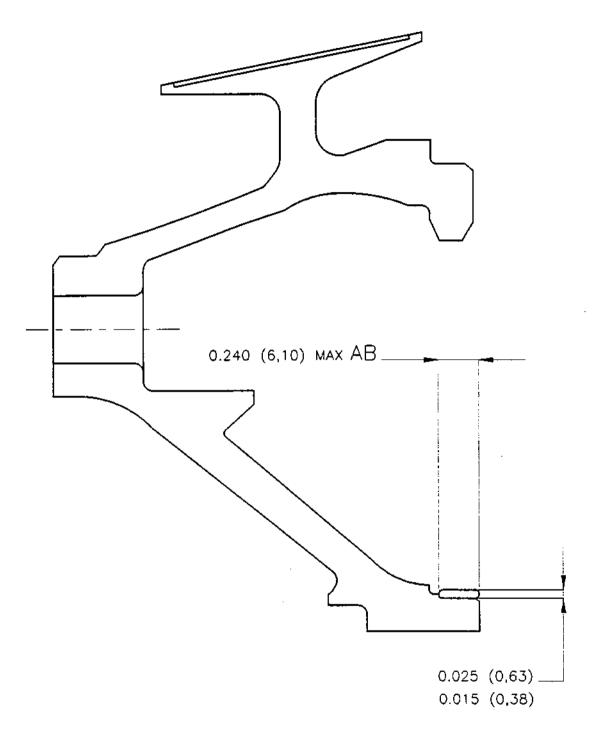
72-33-02 Repair No.40 Page 402 Dec 1/91



VIEW SHOWING THE PRE SPRAY MACHINING FIG.401

REPAIR 72-33-02 Repair No.40 Page 403 Dec 1/91



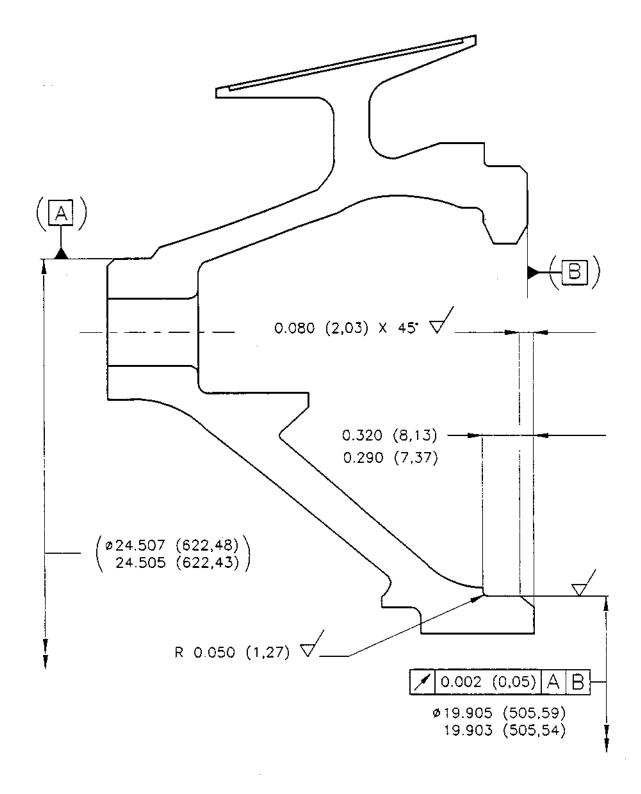


NOTE: OVERSPRAY IS NOT PERMISSIBLE OUTSIDE OF THE DIMENSIONS SHOWN.

VIEW SHOWING APPLICATION OF PLASMA SPRAY. FIG.402

72-33-02 Repair No.40 Page 404 Dec 1/91





VIEW SHOWING THE FINAL MACHINING FIG. 403

REPAIR 72-33-02 Repair No.40 Page 405 Dec 1/91



RING, SPACER, STAGE 2-3

RESTORATION OF FRONT SPIGOT LOCATION BY PLASMA SPRAY

REPAIR NO. B514498

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|-----------|--------------------|
| 72-33-02 | 1 330A | B922835 B922836 |
| | 1 330B | B509594 |
| | | B50959 5 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Maximum permissible pre-spray diameter of spigot location acceptable for repair 15.910(404,11).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Install component in suitable machine and set true to datums A and B. Machine defective diameter AA to remove all evidence of fretting. Remove minimum amount of material to permit successive repairs. For repeat repairs, machine to remove all traces of existing coating.

Refer fig. 401

2) Locally etch to ensure all previous coating has been removed (repeat repairs only). Refer Overhaul Manual Chapter 72-09-14 Repair Solution E.

3) Locally inspect rework area for cracks using fluorescent dye penetrant. Refer TSD 594 OP.210

4) Mask off all areas except diameter marked AA. Refer TSD 594 OP.704 Refer fig.401

5) Abrasive blast diameter marked AA.

Refer TSD 594 OP.704 Use OMAT 184 Refer fig.401

6) Plasma spray coating on diameter marked AA. Apply coating to a sufficient thickness to achieve final dimensions. Overspray on chamfer not permissible. Refer TSD 594 OP.704 Use powder OMAT 3/135. Refer fig.401

- 7) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.
- '8) Install component in suitable machine and set true to datums A and B. Finish machine to dimensions shown.

Refer fig.401 and 402

9) Visually inspect coating using X7 magnification. Refer TSD 594 OP.704 Para B.

REPAIR

72-33-02
Repair No. 41
Page 402
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10) Locally touch-up enamelled/ coated areas adjacent to repair areas (as required). Enamel/coatings must not encroach onto diameter AB. Refer fig.402.

(a) Pre-SB.OL.593-72-8896-347 standard.

Refer Overhaul Manual Chapter 72-09-04 Repair for method and areas not to be enamelled.

(b) SB.OL.593-72-8896-347 standard. Coatings must not encroach into areas marked AD.

Refer TSD 594 OP.349 Para 2.H. Refer fig.402.

11) Mark Repair Instruction no.
RI B514498 or R41 on component
adjacent to normal 'assembly of'
number using the vibro-percussion
engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

Coating symbol HC

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

RING, SPACER, STAGE 2-3 CORROSION RESISTANT

EBH

STEEL MSRR6519

6. DATA

NONE.

7. TOOLS

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

NONE.

REPAIR 72-33-02 Repair No. 41 Page 403 Jun 1/92



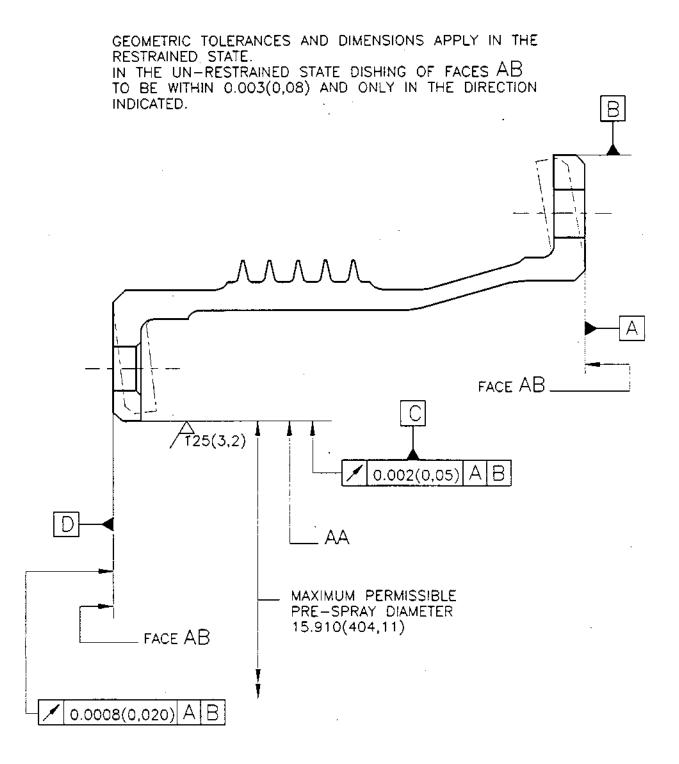


FIG.401

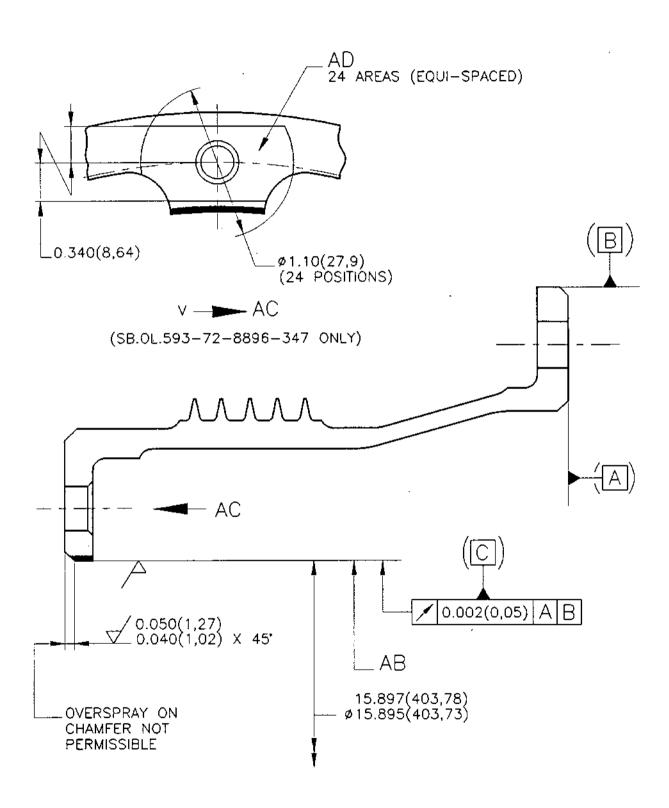


FIG. 402

REPAIR 72-33-02 Repair No. 41 Page 405 Jun 1/92



RING, SPACER, STAGE 2-3

REMOVAL OF CORROSION FROM REAR FLANGE BOLT HOLES BY MACHINING AND POLISHING

REPAIR NO. B514517

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|-----------|-------------------------------|
| 72-33-02 | 1 330A | B922835 |
| | 1 330B | B922836 B509594 B509595 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Maximum depth of corrosion prior to repair 0.005(0,13).

Maximum post machine diameter of bolt holes 0.4086(10,378).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Install component in suitable machine and set true to datums A and B. Ream defective bolt holes to dimensions shown.

Refer fig.401 and fig.402

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Remove corrosion residue by 2) lightly polishing using hand tools only. Remove minimum amount of material.

Refer Para 6. DATA

Locally etch reworked areas. 3)

Refer Overhaul Manual Chapter 72-04-14 Repair Paragraph J, Solution E.

- 4) Binocular inspect using X10 magnification.
- Locally inspect rework areas for 5) cracks using fluorescent dye penetrant.

Refer TSD 594 OP.210

Vapour blast reworked areas. 6)

Refer Overhaul Manual Chapter 72-09-13 Repair Paragraph J, Procedure B.

Mark Repair Instruction no. 7) RI B514517 or R42 on component adjacent to normal 'assembly of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

CORROSION RESISTANT RING, SPACER, STAGE 2-3 STEEL MSRR6519

EBH

DATA 6.

THE DEFINITION OF THE TERM HAND TOOLS ONLY IS DEEMED TO IMPLY THAT THE FOLLOWING MAY BE USED:

GUN - USHIO AIR TOOL COMPANY LTD. TYPE MSG-3BSN 65,000 R.P.M. (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE TYPE A120 HFX.

REPAIR

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NOTE: LOAD/PRESSURE APPLIED WHEN USING THE ABOVE EQUIPMENT

SHOULD NOT BE SUFFICIENTLY GREAT SO AS TO PRODUCE SMOKING AND/OR AN UNPLEASANT ODOUR FROM THE ABRASIVE

AGENT IN THE ABRASIVE WHEEL.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

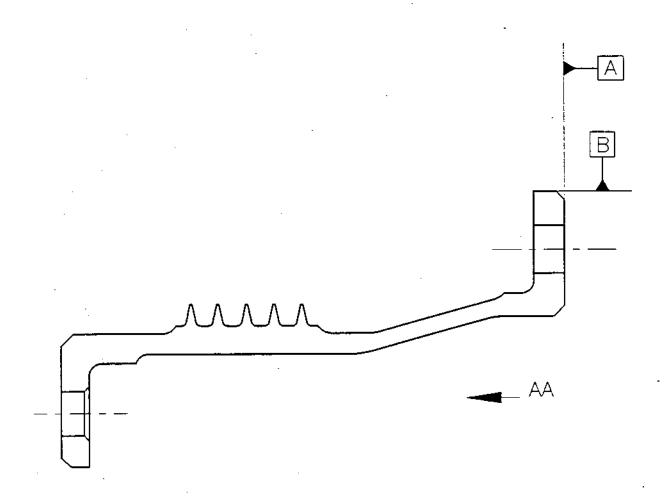
DESCRIPTION

QUANTITY

ITEM

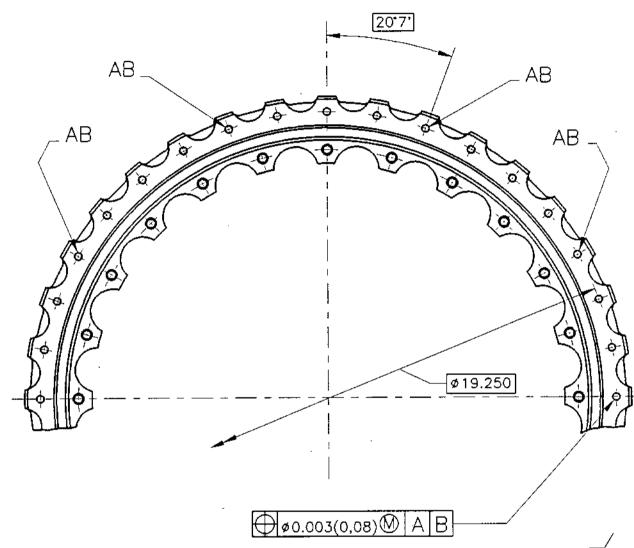
NONE.





TYPICAL SECTION THRU SPACER FIG.401

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36 HOLES Ø0.4086/0.4070 (10.378/10,338)

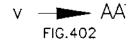
27 HOLES SPACED AS FOR 36

EQUI—SPACED.

9 HOLES EQUI—SPACED MARKED AB

REMOVE SHARP CORNERS (BOTH SIDES)

R. 0.020/0.010(0,51/0,25)\



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LABYRINTH, NO.12

RESTORE WORN LABYRINTH FINS BY MECHANISED T.I.G. WELDING

REPAIR NO. B514548

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|-----------|----------|
| 72-33-02 | 3A 300C | B929466 |
| | | B929467 |
| | | B933206 |
| | | в933207 |
| | 3000 | B512228 |
| | | B512229 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair may only be applied to fins 2 to 7 as identified on figs.402 and 406.

This repair may be embodied up to a maximum of 4 times provided finished dimensional requirements can be maintained.

Labyrinths previously repaired to withdrawn Salvage scheme B488645 may be reworked to this Repair Instruction without restriction.

A test piece validation sample shall be produced and subjected to metallurgical examination; test pieces are required initially, and upon any change of airline operator, sub-contractor, machine or welding equipment.

Authorised Repair Vendors for repair B514548 are listed below:

GE AIRCRAFT ENGINE SERVICES Caerphilly Road Nantgarw Cardiff South Glamorgan CF4 7YJ

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

VALIDATION PROCEDURE

NOTE: Proceed to op.8) where validation is not required.

1) Using conventional machining methods produce test piece from basic part B901069 (in the fully heat treated condition) or use an unserviceable No.12 Labyrinth (which has not previously been welded). Pre-weld dimensions apply.

Refer fig.402 and Table 1 or Refer fig.406 in Table 3.

2) Crack detect.

Refer to TSD 594-J TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-002

3) Prepare for welding.

- Refer TSD 594 OP.409.
- 4) Mechanised Inert gas arc weld to build up prepared fins. Apply sufficient thickness of weld to ensure fins will produce the final machining dimensions.

Refer TSD 594 OP.409. Refer Para.6.1. DATA. Refer fig.401 or fig.405.

- NOTE: Ops.5) to 7) must be carried out by the controlling laboratory.
- 5) Produce four suitable micro~ sections at 90° from the test piece welded surface.

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- 6) Subject the micro-sections to a VPN hardness test using a 5 kg load and a two thirds objective at 0.020 (0,51) increments, traversed across the prepared micro-section faces.
- 7) Check that heat affected zones are within limitations.

Refer fig.401 or fig.405.

NOTE: Do not proceed to op.8)
unless the controlling
laboratory has confirmed
acceptance of validation
sample or sample is not
required at this arising.

RESTORE LABYRINTH FINS

8) Degrease Labyrinth.

Refer TSD 594 OP.101.

9) Heat treat at 1020°C ± 5°C in vacuum. Soak for 1 hour then rapid quench in Argon, reducing temperature to 700°C (max.) in less than 8 minutes.

Support Labyrinth on front face.

CAUTION: Under no circumstances must the heat treatment temperature exceed 1025°C.

10) Locate Labyrinth on fixture.

Refer Para.7. Tools, Item 1.

11) Locate Labyrinth/fixture assembly on a suitable centre lathe and set true to datums. Refer fig.402 or fig.406.

12) Machine the No.12 Labyrinth fins (No.s 2 to 7) to pre-welding dimensions. Refer fig.402 or fig.406.

13) Dimensionally inspect pre-weld fin diameters.

Refer fig. 402 or fig. 406.

14) Remove burrs and sharp edges.

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15) Locally crack detect fin areas.

NOTE: At this stage, also crack detect the front flange inside radius 0.040/0.050 (1,00/1,27) adjacent the bolt holes.

Cracks are not permitted at either position.

Refer fig.402 or fig.406. Refer to TSD 594-J TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002 Use OMat 651.

16) Mechanised Inert gas arc weld to build up prepared fins. Apply weld metal 0.090 (2,29) min. thick to ensure fins will produce the final machining dimensions. Refer TSD 594 OP.409. Refer Para.6.1. DATA. Refer fig.401 or fig.405.

17) Visually inspect welded areas.

Refer TSD 594 OP.409.

18) Dimensionally inspect to ensure sufficient weld metal has been applied to clean up during final machining. Refer fig.401 and fig.403 or Refer fig.405 and fig.403.

19) Finish machine fins (all features except outside diameters AB). Part machine outside diameters of fins AB to ensure sufficient weld metal has been applied to clean up during final machining.

Refer fig. 403 and Table 2.

NOTE: If fin(s) fail to clean up, or it is evident outside diameter(s) will not clean up at op.29), return to op.10) and repeat repair.

- 20) Remove burrs and sharp edges.
- 21) Degrease Labyrinth.

Refer TSD 594 OP.101.

22) Heat treat at 1020°C ± 5°C in vacuum. Soak for 1 hour then rapid quench in Argon, reducing temperature to 700°C (max.) in less than 8 minutes.

Support Labyrinth on front face.

CAUTION: Under no circumstances must the heat treatment temperature exceed 1025°C.

- 23) Heat treat at 850°C ± 10°C in vacuum.

 Soak for 4 hours then rapid quench in Argon. Support Labyrinth on front face.
- 24) Heat treat at 760°C ± 10°C in vacuum.

 Soak for 16 hours then rapid quench in Argon. Support Labyrinth on front face.
- 25) Dimensionally inspect to ensure welding/heat treatment distortion is within repair limitations.

Refer fig.403.

26) Crack detect.

Refer to TSD 594-J TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-001

27) Locate Labyrinth on fixture.

Refer Para.7. Tools, Item 1.

28) Locate Labyrinth/fixture assembly on a suitable centre lathe and set true to datums. Refer fig.403.

29) Finish machine the No.12 Labyrinth fin diameters AB.

Refer Para.6.2. DATA. Refer fig.403.

30) Dimensionally inspect fins and ensure component is within repair geometric tolerances in the fully restrained condition.

Refer fig. 403.

31) Remove burrs and sharp edges.



| | OVERNAGE | • |
|-----|---|---|
| 32) | Degrease labyrinth. | Refer TSD 594 OP.101. |
| 33) | Mask off Labyrinth, leaving only the repair area exposed, for chemical etching. | Refer OMat 281. |
| 34) | Chemically etch repair area by immersion in solution for 2 minutes. | Refer Overhaul Manual Chapter 72-09-14 Repair, Solution C. |
| 35) | Remove maskant. | |
| 36) | Degrease Labyrinth. | Refer TSD 594 OP.101. |
| 37) | Locally crack detect fin areas. | Refer to TSD 594-J TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002 |
| 38) | Mask off Labyrinth, leaving only the etched areas exposed, using mechanical mask(s) and/or paper tapes. | Refer OMat 230. |
| 39) | Vapour blast repair areas to remove the effects of etching. | Refer Overhaul Manual, Chapter 72-09-13 Repair, Procedure B. |
| 40) | Visually inspect for removal of the effects of etching. | Use X 7 magnification (approximately). |
| 41) | Remove mask(s) and/or paper tapes. | |
| 42) | Mark Repair Instruction number RI B514548 or R43 adjacent to the normal 'assy of' no. using the vibro-percussion engraving technique. | Refer Overhaul Manual Chapter 72-09-00 Repair. |
| | | |

MATERIAL

WASPALOY (BSEM735)

5.

MATERIAL

COMPONENT

LABYRINTH, NO.12

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RR CODE



6. DATA

6.1 WELDING:

WELD TEST PIECES APPROVED BY VALIDATION.

WELD DATA CARDS RETAINED BY LABORATORY.

6.2 MACHINING:

Tool type : ISO K20

Coolant type: Soluble oil Speed : 9.7 R.P.M.

Speed Feed

: 0.001 (0,03) - Manual

Depth of cut: 0.005 (0,13) Minimum

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

S3S12368000

LOCATION FIXTURE

1

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

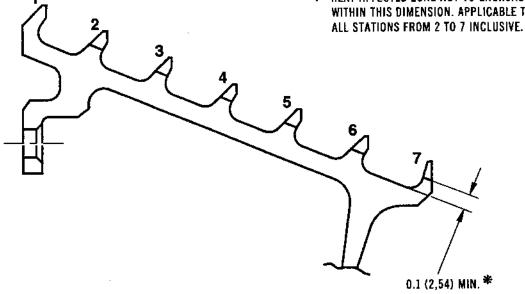
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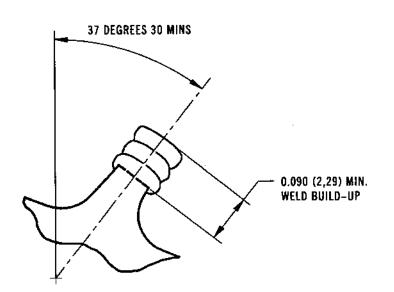
NOTE: STANDARD BASIC PART 8901069 MAY BE REQUIRED FOR

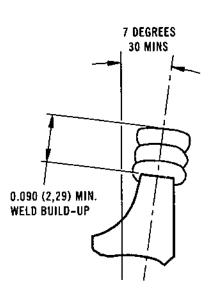
VALIDATION. REFER TO REPAIR PROCEDURE FOR DETAILS.



* HEAT AFFECTED ZONE NOT TO ENCROACH WITHIN THIS DIMENSION. APPLICABLE TO







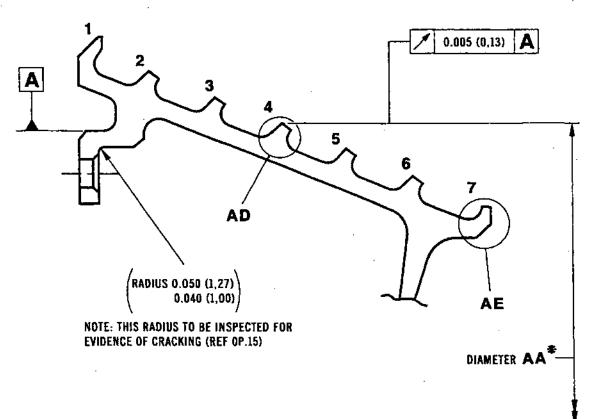
FIN 2 TO 6

FIN 7

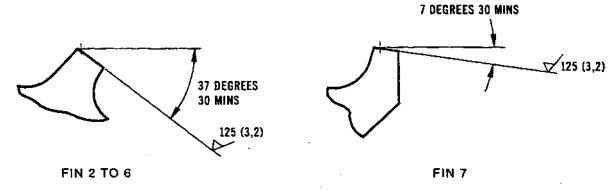
Mechanised T.I.G. Welding Method Fig.401

REPAIR

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* FOR DIAMETER AA DIMENSIONS REFER TO TABLE 1 (FIG. 404)



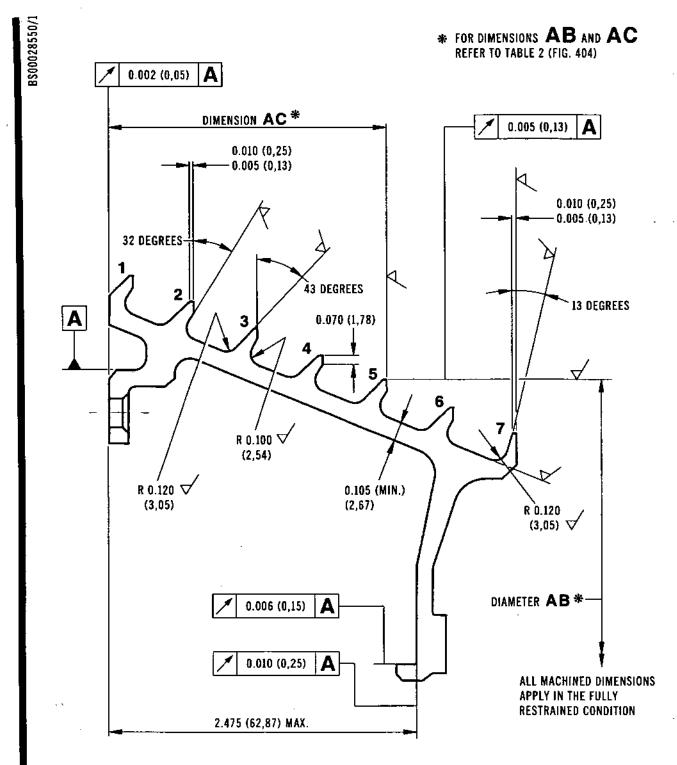
ENLARGED DETAIL AD

ENLARGED DETAIL AE

Pre-Weld Dimensions Machinised T.I.G. Welding Method Fig.402

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Final Dimensions Fig. 403

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BS00028551/1

| STATION | DIAMETER AA |
|---------|------------------------------------|
| 1 | DO NOT MACHINE |
| 2 | 22.115 (561,72) 22.110 (561,59) |
| 3 | 21.685 (550,80) 21.670 (550,42) |
| 4 | 21.245 (539,62) 21.230 (539,24) |
| 5 | 20.800 (528,32) 20.785 (527,94) |
| 6 | 20.350 (516,89) 20.335 (516,51) |
| 7 | 19.902 (505,51) 19.887 (505,13) |

TABLE 1

| STATION | DIAMETER AB | DIMENSION AC |
|---------|------------------------------------|--------------------------------|
| 1 | DO NOT Machine | DO NOT MACHINE |
| 2 | 22.250 (565,15) 22.245 (565,02) | 0.665 (16,89) 0.655 (16,64) |
| 3 | 21.820 (554,23) 21.815 (554,10) | 1.175 (29,85) 1.165 (29,59) |
| 4 | 21.380 (543,05) 21.375 (542,93) | 1.685 (42,80) 1.675 (42,55) |
| 5 | 20.934 (531,72) 20.929 (531,60) | 2.195 (55,75) 2.185 (55,50) |
| 6 | 20.485 (520,32) 20.480 (520,19) | 2.705 (68,71) 2.695 (68,45) |
| 7 | 20.037 (508,94) 20.032 (508,81) | 3.215 (81,66) 3.205 (81,41) |

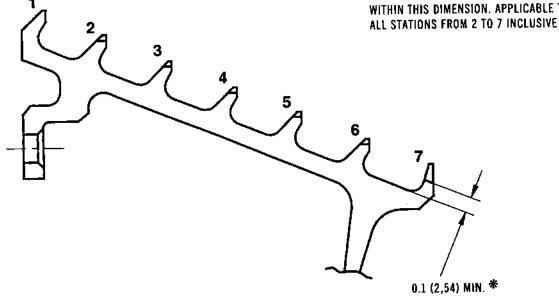
TABLE 2

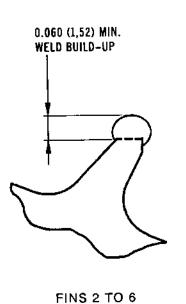
Mechanised T.I.G. Welding Method Machining Dimensions Fig.404

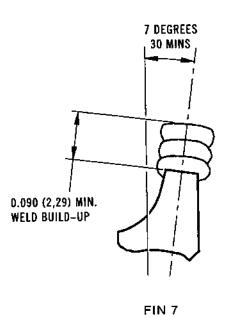
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BS00028552/1

* HEAT AFFECTED ZONE NOT TO ENCROACH
WITHIN THIS DIMENSION, APPLICABLE TO



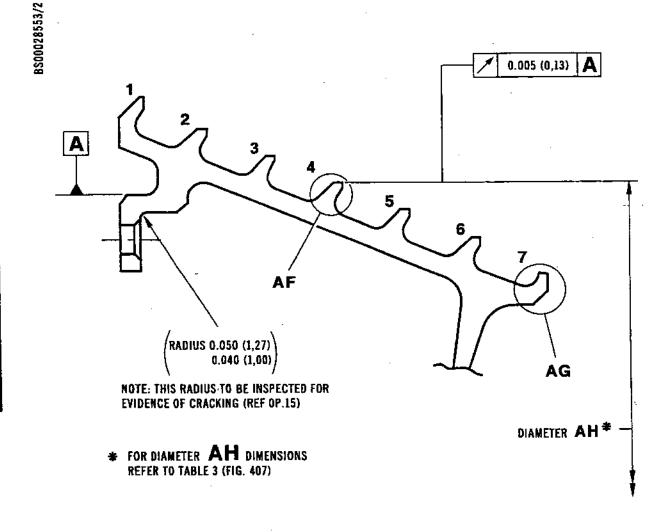


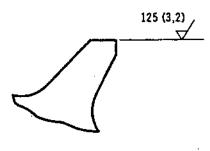


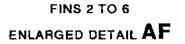
Pulsed T.I.G. Dabber Welding Method Fig.405

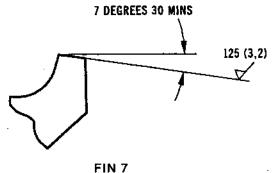
REPAIR

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ENLARGED DETAIL AG

Pre-Weld Dimensions
Pulsed T.I.G. Dabber Welding Method
Fig.406

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| STATION | DIAMETER AH |
|---------|------------------------------------|
| 1 | DO NOT Machine |
| 2 | 22.200 (563,88) 22.195 (563,75) |
| 3 | 21.770 (552,96) 21.765 (552,83) |
| 4 | 21.330 (541,78) 21.325 (541,66) |
| 5 | 20.884 (530,45) 20.879 (530,33) |
| 6 | 20.435 (519,05) 20.430 (518,92) |
| 7 | 19.902 (505,51) 19.887 (505,13) |

TABLE 3
PULSED T.I.G. DABBER WELDING METHOD

Pulsed T.I.G. Dabber Welding Method Machining Dimensions Fig.407

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SHAFT, DRIVE, COMPRESSOR HP

REMOVAL OF CORROSION AND/OR SCORING FROM FRONT FLANGE BOLT HOLES BY BLENDING AND POLISHING

REPAIR NO. 8514987

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | Part No. |
|------------|------------------|----------|
| 72-33-02 | 3 330B | B925461 |
| | | B925462 |
| | | B923990 |
| | | B923991 |
| | | B935451 |
| | | B935452 |
| | | B935454 |
| | | B935455 |
| | 330p | B512232 |
| | | B512233 |
| | | B512234 |
| | | B512235 |
| | | B512236 |
| | | B512237 |
| | | B512238 |
| | | 8512239 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Maximum depth of corrosion prior to repair 0.005(0,13).

Blending of corrosion is limited to areas AC of holes only (Refer to Fig. 402).

Maximum depth of scoring prior to repair 0.003(0,08).

Scoring and resultant blending may extend through 360 degrees.

Maximum number of scores per bore 3.

Maximum depth of any blend 0.005(0,13).

This repair may be carried out any number of times provided that the maximum blend depth is not exceeded.

REPAIR

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 32 (0,8) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Remove corrosion and/or scoring by lightly blending using hand tools only. Polish to maintain surface finish. Remove minimum amount of material. Refer Para.6. DATA Refer Figs.401 and 402.

Locally etch reworked areas.

Refer Overhaul Manual Chapter 72-09-14 Repair using Solution C.

- 3) Binocular inspect using X10 magnification.
- 4) Locally crack detect.

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check.

5) Vapour blast etched areas.

Refer Overhaul Manual Chapter 72-09-13 Repair using Procedure B.

6) Mark Repair Instruction number RI B514987 or R44 on component adjacent to the normal 'assembly of' number using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

SHAFT, DRIVE, COMPRESSOR HP WASPALOY BSEM735 ---

REPAIR

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6. DATA

THE DEFINITION OF THE TERM HAND TOOLS ONLY IS DEEMED TO IMPLY THAT THE FOLLOWING MAY BE USED:

GUN - USHIO AIR TOOL COMPANY LTD. TYPE MSG-3BSN 65,000 R.P.M. (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE TYPE A120 HFX.

NOTE: LOAD/PRESSURE APPLIED WHEN USING THE ABOVE EQUIPMENT SHOULD NOT BE SUFFICIENTLY GREAT SO AS TO PRODUCE SMOKING AND/OR AN UNPLEASANT ODOUR FROM THE ABRASIVE AGENT IN THE ABRASIVE WHEEL.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

NONE.

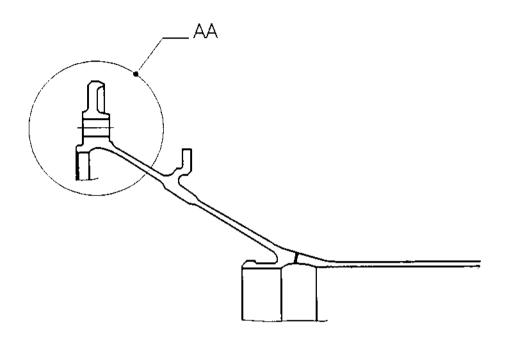
8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.

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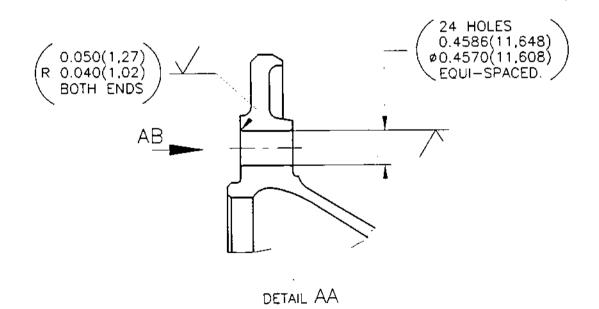
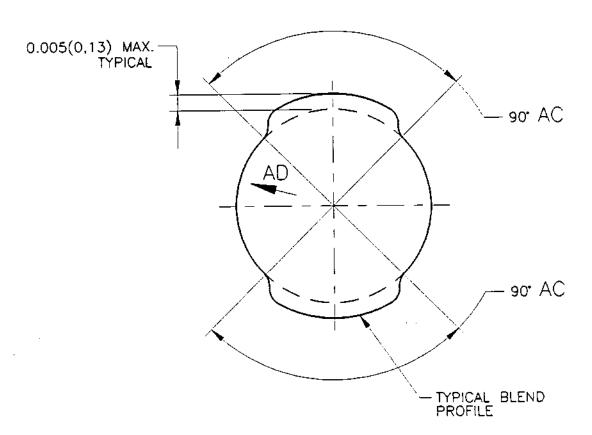


FIG.401

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DIAGRAMMATIC VIEW — AB (SHOWING BLENDING OF CORROSION)

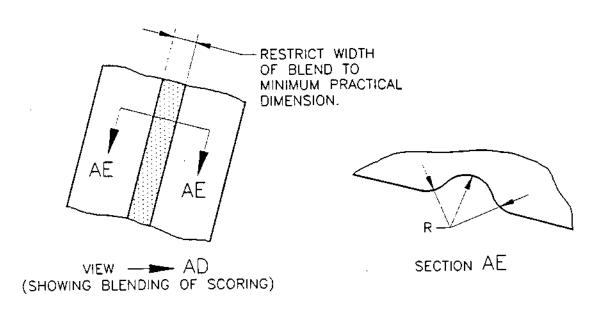


FIG.402

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OVERHAUL

DISK, COMPRESSOR ROTOR, HP STAGE 1

PROVISION FOR LOCAL TOUCH-UP OR - RE-APPLICATION OF ANTI-FRET COATING

REPAIR NO. B514428

1. **EFFECTIVITY**

| 72-33-02 1 230E B506873 B506874 B506875 B506876 B506877 B506878 B506879 B506880 B506881 B506882 B506883 | IPC | Fig. | . / | Item | | Ρ | ar | t | N | ο. |
|---|----------|------|-----|------|--|---|---|--|-----------------|-----------------|
| B506917 B506918 B506920 B506922 B506923 B513649 | 72-33-02 | | | 230E | | 888888888888888888888888888888888888888 | 50 50 50 50 50 50 50 50 50 50 50 50 50 5 | 68 68 68 68 68 68 68 68 68 68 68 68 68 6 | 777778888911222 | 456789012378023 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED Drawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimetres) Tolerances on machined dimensions plus/minus 0.010 (0.25) Tolerance on angles plus/minus 2 degrees Break sharp edges 0.004 to 0.020 (0.1 to 0.5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

REPAIR

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Dec 1/95

4. REPAIR PROCEDURE

LOCAL TOUCH UP METHOD

- Locally degrease areas to be coated using liquid degreasant and clean, dry, lint free cloth.
- 2) Mask off areas not to be coated using masking tape.
- 3) Apply anti-fret coating to surfaces marked AC by brush to achieve a finished coating thickness of 0.0001 to 0.0003 (0,003 to 0,008).

 Overspill is permissible on surfaces AD.
- 4) Remove all traces of masking.
- 5) Stove part at 185 to 195°C (365 to 383°F) for 2 hours.
- 6) Visually inspect coating. The coating should be uniform in colour, smooth, adherent and free from flaking and cracking.

RE-APPLICATION METHOD

- Strip existing anti-fret coating.
- 2) Fluorescent dye check disk, paying particular attention to the disk root slots.
- Vapour degrease component.
- 4) Wet abrasive blast areas within AC using 320/400 mesh aluminium oxide grit. Use a pressure of 60-80 lbf.in. (414-552 kPa) and a working distance of 4-6 (100-150).

SUPPLEMENTARY INFORMATION

Refer Overhaul Manual Chapter 72-09-00 Cleaning, Para.6.

Use masking tape OMat 237 or OMat 2/40. Refer fig.402.

Refer Overhaul Manual Chapter 72-09-18 Repair. Refer fig.402. Coating PL239 (OMat 4/44).

Refer Overhaul Manual Chapter 72-09-00 Cleaning Para. 4.D.

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check

Refer Overhaul Manual Chapter 72-09-00 Cleaning, Para.5.

Refer Overhaul Manual Chapter 72-09-18 Repair. Refer fig.402.

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Note: Handle component with care in order to avoid contamination of the surfaces to be coated.

5) Mask off areas not to be coated using masking tape. Use masking tape OMat 237 or OMat 2/40. Refer fig.402.

6) Apply two coats of anti-fret coating to surfaces marked AC by spraying to achieve a finished coating thickness of 0.0001 to 0.0003 (0,003 to 0,008).

Overspray is permissible on surfaces marked AD.
Allow a minimum air drying period of 10 minutes between each coat.

Refer Overhaul Manual Chapter 72-09-18 Repair. Refer fig.401 and 402. Coating PL239 (OMat 4/44).

- 7) Remove all traces of masking.
- 8) Stove part at 185 to 195°C (365 to 383°F) for 2 hours.
- 9) Visually inspect coating. The coating should be uniform in colour, smooth, adherent and free from flaking and cracking.
- 5. MATERIAL

COMPONENT MATERIAL RR CODE

DISK, COMPRESSOR ROTOR, HP STAGE 1 TITANIUM TCT
MSRR 8634

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION

ITEM

NONE.



8. REPLACEMENT PARTS

PART NUMBER

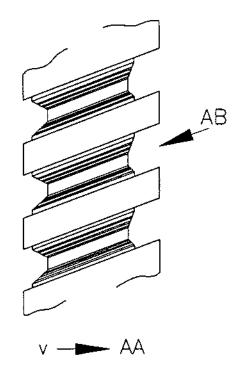
DESCRIPTION

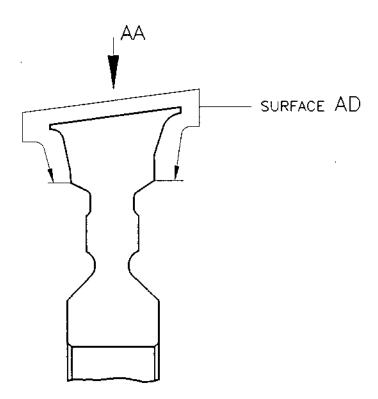
QUANTITY

ITEM

NONE.

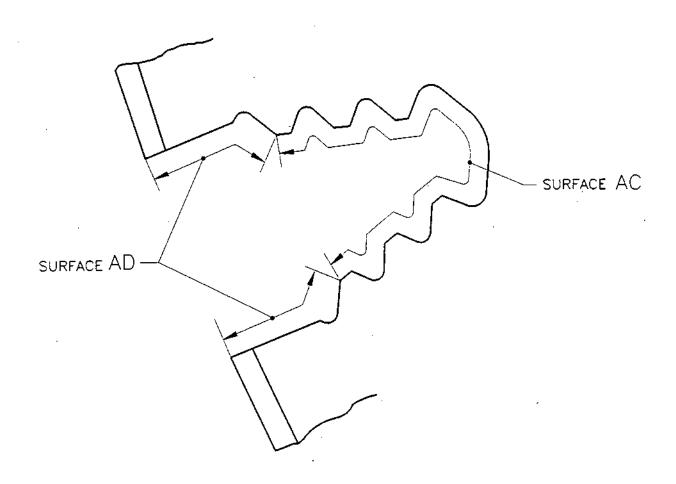
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GENERAL SECTION THROUGH DISK FIG.401

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V — AB

TYPICAL 34 POSITIONS

FIG.402

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BLADE, COMPRESSOR, HP STAGE 1

PROVISION FOR LOCAL TOUCH-UP OR RE-APPLICATION OF ANTI-FRET COATING

REPAIR NO. B514429

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|-----------|--|
| 72-33-02 | 1 210F | B506862 B506863 B506864 B506865 B506866 B506867 B506868 B506870 B506871 B506872 |

2. <u>REPAIR LIMITATIONS</u>

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

LOCAL TOUCH-UP METHOD

 Locally degrease areas to be coated using liquid degreasant and clean, dry, lint free cloth.

Refer Overhaul Manual Chapter 72-09-00 Cleaning, Para.6.

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Mask off areas not to be coated using masking tape. Use masking tape OMat 237 or OMat 2/40. Refer fig.402.

3) Apply anti-fret coating to surfaces marked AC by brush to achieve a finished coating thickness of 0.0001 to 0.0003 (0,003 to 0,008).

Overspill is permissible on surfaces AD.

Refer Overhaul Manual Chapter 72-09-18 Repair. Refer fig.402. Coating PL239 (OMat 4/44).

- 4) Remove all traces of masking.
- 5) Stove part at 185 to 195°C (365 to 383°F) for 2 hours.
- 6) Visually inspect coating. The coating should be uniform in colour, smooth, adherent and free from flaking and cracking.

RE-APPLICATION METHOD

- 1) Strip existing anti-fret coating. Refer TSD 594 OP.103
- Fluorescent dye check blade paying particular attention to the root serration area.

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check

3) Vapour degrease component.

Refer Overhaul Manual Chapter 72-09-00 Cleaning, Para.5.

4) Wet abrasive blast areas within AE using 320/400 mesh aluminium oxide grit. Use a pressure of 60-80 lbf.in (414-552 kPa), working distance 4-6 (100-150).

Refer Overhaul Manual Chapter 72-09-18 Repair. Refer fig.402.

Note: Handle component with care in order to avoid contamination of the surfaces to be coated.

5) Mask off areas not to be coated using masking tape.

Use masking tape OMat 237 or OMat 2/40. Refer fig.402.

72-33-02 Repair No. 47 Page 402 Jun 30/95 6) Apply one coat of anti-fret coating to surfaces marked AC by spraying to achieve a finished coating thickness of 0.0001 to 0.0003 (0,003 to 0,008).

Overspray is permissible on surfaces marked AD.
Discolouration of unloaded flanks is permissible.

Refer Overhaul Manual Chapter 72-09-18 Repair. Refer fig.401 and 402. Coating PL239 (OMat 4/44).

- 7) Remove all traces of masking.
- 8) Stove part at 185 to 195°C (365 to 383°F) for 2 hours.
- 9) Visually inspect coating. The coating should be uniform in colour, smooth, adherent and free from flaking and cracking.
- 5. MATERIAL

COMPONENT MATERIAL RR CODE

BLADE, COMPRESSOR, HP STAGE 1 TITANIUM TAF
MSRR 8610

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION

ITEM

NONE.

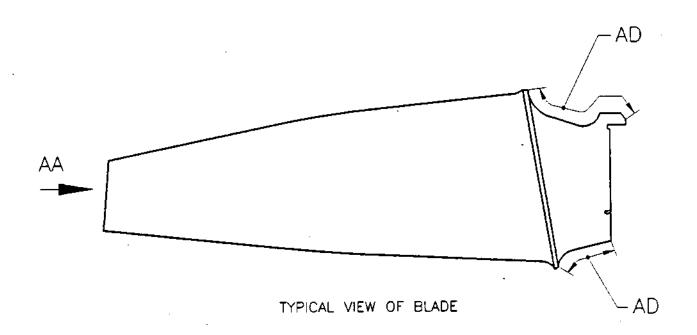
8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.

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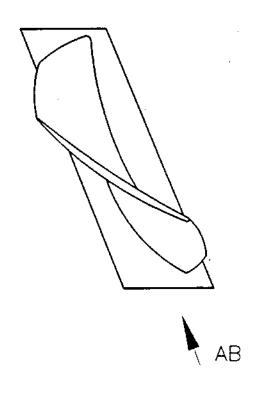




FIG.401

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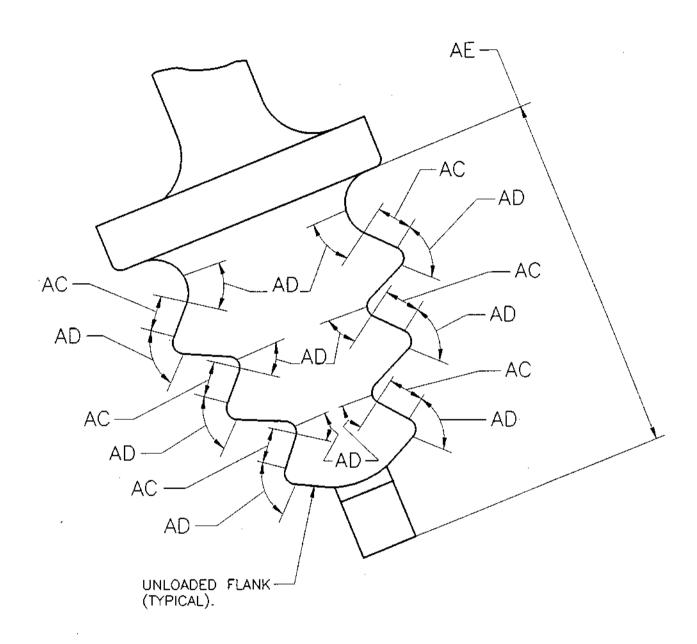




FIG.402



TUBE, ASSEMBLY OF, AIR TRANSFER

REMOVAL AND REPLACEMENT OF COATING

REPAIR NO. B515456

1. EFFECTIVITY

<u>IPC</u> <u>Fig./Item</u>

Part No.

72-33-02

3 400C

B514411

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair may only be used when:-

- 1) Diameter AA does not exceed 12.235 (310,77). Refer fig.401.
- 2) After machining to remove coating, the resultant wall section is not less than 0.080 (2,79). Refer fig.401.
- 3) After finish machining, coating thickness does not exceed 0.025 (0,64).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Dimensionally inspect. Ensure diameter AA does not exceed the stated dimension. Refer fig. 401.

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| 2) | Load component on machine and |
|----|-------------------------------|
| | set true to datum A. Machine |
| | to completely remove coating. |
| | Remove minimum amount of |
| | parent material to clean up. |

Refer fig.401.
Refer repair limitations.
Refer para.7. TOOLS.

3) Locally swab etch to ensure coating is completely removed. Refer Overhaul Manual Chapter 72-09-14 Repair, Solution E.

4) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210.

5) Dimensionally inspect.

Refer fig.401. Refer repair limitations.

6) Mask off areas not to be coated. Spray machined diameter with bond coat followed by top coat.

NOTE: Bond coat to be of sufficient thickness to allow achievement of 0.006/0.008 (0,15/0,20) top coat thickness after finish machining.

Refer Overhaul Manual Chapter 72-09-06 Repair and TSD 594 OP.704 using bond coat OMat 3/188 and top coat OMat 3/81. Refer repair limitations.

7) Visually inspect coating for defects.

Refer TSD 594 OP.704 section 8.

8) Load component on grinding machine and set true to datum A. Machine to produce finished dimensions.

Refer fig.401. Refer para.7. TOOLS.

9) Dimensionally inspect.

Refer fig.401.

10) Visually inspect coating for defects.

Refer TSD 594 OP.704 section 8.

11) Mark Repair Instruction number RI B515456 or R48 on component adjacent to normal 'assy. of' no. using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

<u>COMPONENT</u>

MATERIAL

RR CODE

TUBE, ASSEMBLY OF, AIR TRANSFER.

MSRR6508 JETHETE **EBJ**

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6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

S3S15334000 MACHINING FIXTURE 1

8. REPLACEMENT PARTS

PART_NUMBER DESCRIPTION ITEM

NONE.



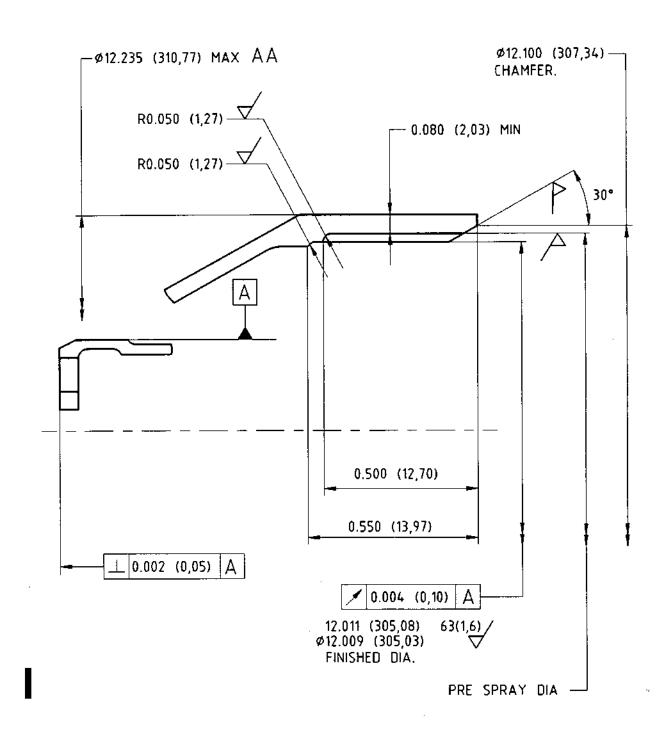


FIG.401



DISK, COMPRESSOR ROTOR, HP STAGE 2

PROVISION FOR THE RESTORATION OF FRONT AND/OR REAR LOCATION DIAMETERS BY PLASMA SPRAYING

REPAIR NO. B515436-7

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | Part No. |
|------------|-----------|---|
| 72-33-02 | 1 /300b | B509592 B512724 B509593 B512725 B512723 B512726 |
| | 1 /300E | B512567 B512741 B512570 B512742 B512740 B512743 |
| | 1 /300F | B516997 B517000 B516998 B517001 B516999 B517002 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

The minimum repairable diameter of the front location diameter (B515436) is 15.248(387,30). Refer fig.403.

The minimum repairable diameter of the rear location diameter (B515437) is 15.886(403,50). Refer fig.406.

Repair Instructions B515436 and B515437, (operations 2 to 13), must not be applied simultaneously or a loss of datums will result.

Geometric tolerances and dimensions apply in the restrained state.

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES16D)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63(1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

B515436: RESTORATION OF FRONT LOCATION DIAMETER.

<u>CAUTION:</u> During repair of this component its surfaces must be protected from corrosion at all times, work to procedure detailed in Overhaul Manual Chapter 72-09-20 Repair using dewatering oil.

Remove corrosion resistant coating.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use process F.

REPEAT REPAIRS ONLY

2) Chemically strip existing coating.
NOTE: If rear location diam

NOTE: If rear location diameter has previously been Plasma Sprayed, mask coated areas to prevent loss of datum B.

Refer Overhaul Manual Chapter 72-09-25 Repair. Use process A. Refer fig.401.

Alternative: Existing coating may be removed by machining to operation 4) and 5). Remove minimum parent material.

3) Locally etch to ensure all previous coating has been removed. Proceed directly to operation 6 (if satisfactory). Refer Overhaul Manual Chapter 72-09-14 Repair. Use solution E.

NEW ARISINGS

4) Assemble component to a suitable lathe and set true to datums A and B.

Refer Fig. 401.

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5) Machine the front location diameter.

Refer Fig. 403.

6) Dimensionally inspect.

Refer Fig. 403.

7) Crack detect repair area.

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check.

8) Mask off areas not to be coated. Plasma spray front location diameter over length AH to a minimum thickness of 0,015(0,38).

Refer Fig. 405. Refer TSD 594 OP. 704. Use OMat 3/179.

9) Visually inspect coating for defects. Refer TSD 594 OP.704.

10) Assemble component to a suitable lathe and set true to datums A and B.

Refer Fig. 401.

11) Finish machine the plasma sprayed coating on the front location diameter.

Refer Fig. 404.

12) Dimensionally inspect.

Refer Fig. 404.

13) Visually inspect coating for defects.

Refer Overhaul Manual Chapter 72-09-11 Repair.

14) Mark Repair Instruction number RI B515436 or R.49A on component adjacent to normal 'assembly of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig. 402 for identity marking location.

Coating identity



NOTE: At this point Mod.72-9020 must be effected to post Mod.72-8925 components and to post Mod.72-8896 components if required. Re-part number accordingly. If Mod.72-9020 is not effected to post Mod.72-8896 components, complete repair to B515437 Operations 15, 16, 17 and 18. For post Mod.72-9020 components, complete repair to B515437 Operations 19, 20, 21 and 22.

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Repair No. 49
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B515437: RESTORATION OF REAR LOCATION DIAMETER.

<u>CAUTION:</u> During repair of this component its surfaces must be protected from corrosion at all times, work to procedure detailed in Overhaul Manual Chapter 72-09-20 Repair using dewatering oil.

Remove corrosion resistant coating.

Refer Overhaul Manual Chapter 72-09-00 Cleaning. Use process F.

REPEAT REPAIRS ONLY

Chemically strip existing coating.
NOTE: If front location diameter

TE: If front location diameter has previously been Plasma Sprayed, mask coated areas to prevent loss of datum D.

Refer Overhaul Manual Chapter 72-09-25 Repair. Use process A. Refer fig.401.

Alternative: Existing coating may be removed by machining to operation 4) and 5). Remove minimum parent material.

3) Locally etch to ensure all previous coating has been removed. Proceed directly to operation 6 (if satisfactory). Refer Overhaul Manual Chapter 72-09-14 Repair. Use solution E.

NEW ARISINGS

4) Assemble component to a suitable lathe and set true to datums A and D. Refer Fig. 401.

5) Machine the rear location diameter.

Refer Fig. 406.

6) Dimensionally inspect.

Refer Fig. 406.

7) Crack detect repair area.

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check.

8) Mask off areas not to be coated. Plasma spray rear location diameter over length AJ to a minimum thickness of 0.015(0,38).

Refer Fig. 405. Refer TSD 594 OP. 704 Use OMat 3/179.

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9) Visually inspect coating for defects. Refer TSD 594 OP.704.

10) Assemble component to a suitable lathe and set true to datums A and D.

Refer Fig. 401.

11) Finish machine the plasma sprayed coating on the rear location diameter.

Refer Fig. 407.

12) Dimensionally inspect.

Refer Fig. 407.

13) Visually inspect coating for defects.

Refer Overhaul Manual Chapter 72-09-11 Repair.

14) Mark Repair Instruction number RI B515437 or R.49B on component adjacent to normal 'assembly of' number using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig. 402 for identity marking location.

Coating identity



NOTE: At this point Mod.72-9020 must be effected to post Mod.72-8925 components and to post Mod.72-8896 components if required. Re-part number accordingly. If Mod.72-9020 is not effected to post Mod.72-8896 components, complete repair to Operations 15, 16, 17 and 18. For post Mod.72-9020 components, complete repair to Operations 19, 20, 21, 22 and 23.

15) Derust to remove all corrosion products.
NOTE: This procedure to be completed not more than 24 hours prior to painting.

Refer Overhaul Manual Chapter 72-09-00 cleaning. Use Process H.

16) Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots and hatched areas marked AD).

NOTE: Identity markings to remain visible after application of coating.

Refer TSD 594 OP.349 using Omat 7/46 (Type A, stoved at 515 deg.C or Type B coating).
Refer Figs.408, and 409.

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17) Apply corrosion resistant seal coating on top of the corrosion resistant coating.

NOTE: Areas AE are to be brush touched up on assembly.

Refer TSD 594 OP.349 using Omat 7/168.

Refer TSD 594 OP.349 using Omat 7/22.

18) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.

FOR POST MOD.72-9020 COMPONENTS ONLY.

19) Perust to remove all corrosion products.
NOTE: This procedure to be completed not more than 24 hours prior to painting.

Refer Overhaul Manual Chapter 72-09-00 cleaning. Use Process H.

20) Apply corrosion resistant coating all over except bolt holes, spigot diameters, blade slots (over areas marked AG) and hatched areas marked AD.

NOTE: Identity markings to remain visible after application of coating.

Refer TSD 594 OP.349 using Omat 7/46 (Type A stoved at 515 deg.C or Type B coating).
Refer Figs.408, 409 and 410.

21) Apply corrosion resistant seal coating on top of the corrosion resistant coating.

NOTE: Areas AE are to be brush touched up on assembly.

Refer TSD 594 OP.349 using Omat 7/168.

Refer TSD 594 OP.349 using Omat 7/22.

22) Inspect fir tree root to blade clearance.

Use blade root gauge or master top limit blade. Refer para 7. TOOLS item 1.

23) Finally visually inspect the disk to ensure the repair has been carried out satisfactorily.

5. MATERIAL

COMPONENT

<u>MATERIAL</u>

RR CODE

DISK, COMPRESSOR ROTOR, HP STAGE 2.

MSRR 6519 FV 535 **EBH**

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6. DATA

A. PRE-COATING MACHINING.

TOOL: ISO K10/K20.

LUBRICANT: G.P soluble oil.

SPEED: 42 RPM.

FEED: 0.006(0,15) Hand.

B. POST-COATING MACHINING.

TOOL: ISO K range.

LUBRICANT: G.P soluble oil.

SPEED: 33 to 38 RPM.

FEED: Manual.

7. TOOLS

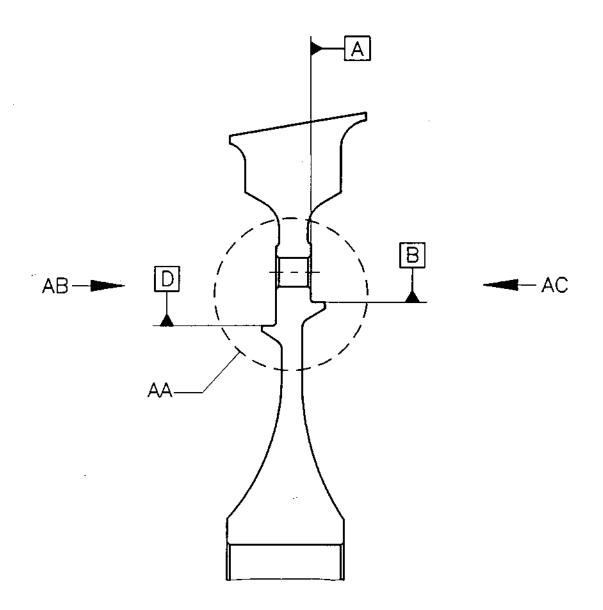
TOOL NUMBER DESCRIPTION ITEM

\$3\$14926000 GAUGE 1

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION ITEM

NONE.



TYPICAL SECTION THROUGH DISK

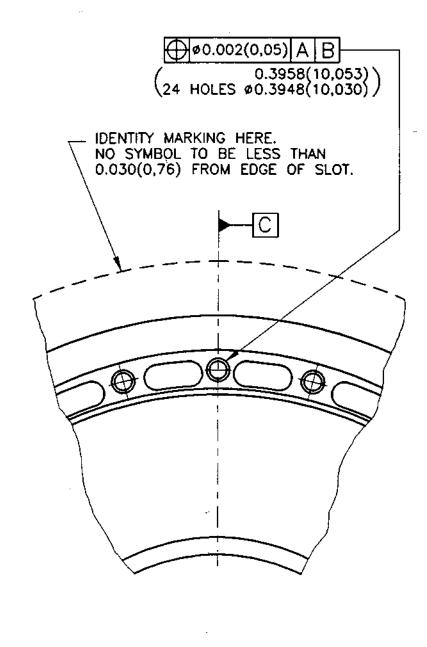
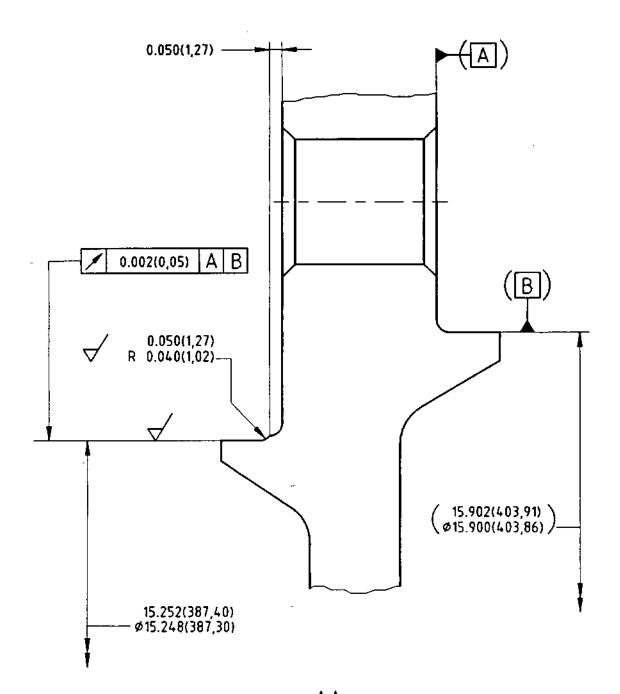


FIG.402

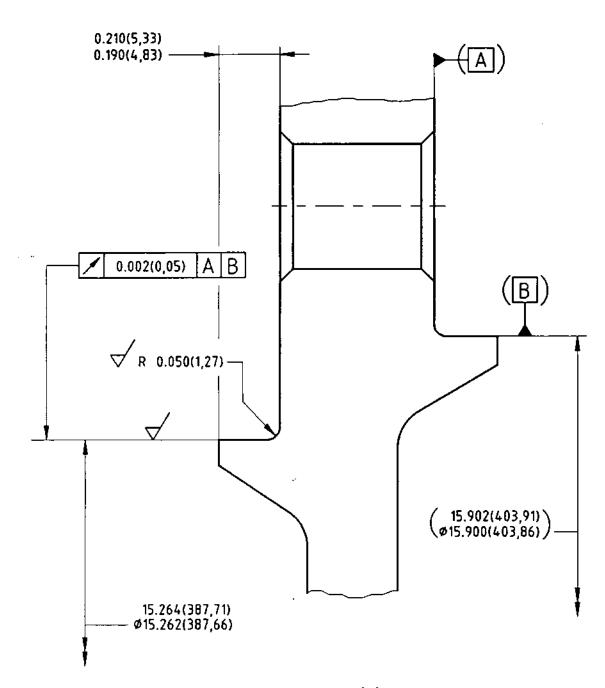
- AC





DETAIL AA
SHOWING THE PRE-SPRAY MACHINING DIMENSIONS
FOR THE FRONT LOCATION DIAMETER.
FIG. 403

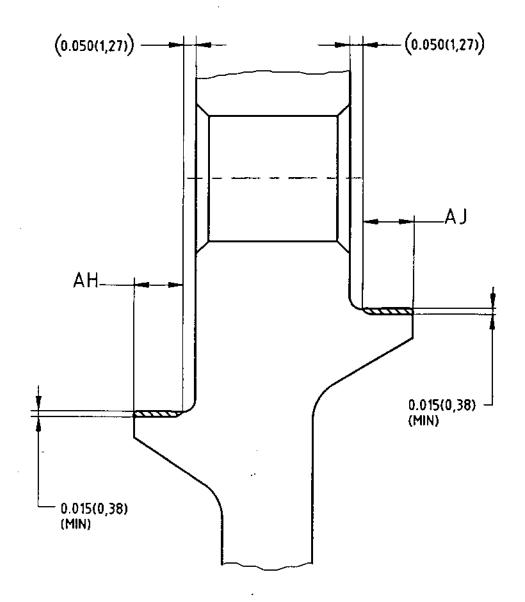
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REPEAT DETAIL AA
SHOWING THE FINAL MACHINING DIMENSIONS
FOR THE FRONT LOCATION DIAMETER.
FIG.404

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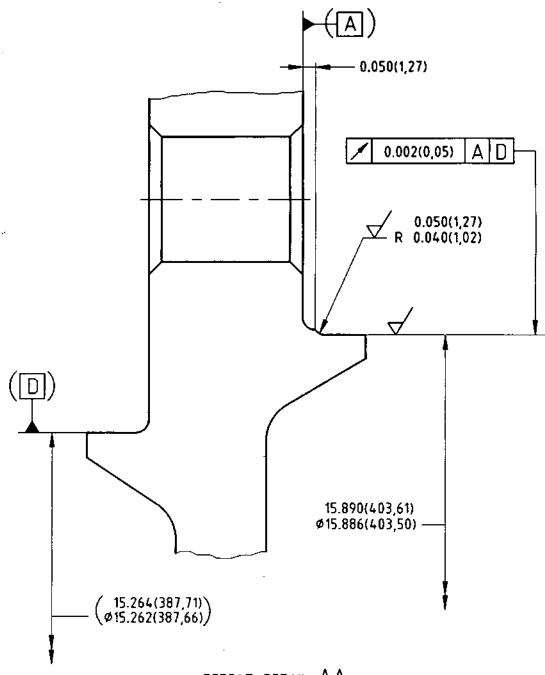


PLASMA SPRAY AREAS WITHIN AH AND AJ

NB. OVERSPRAY IS NOT PERMISSIBLE
OUTSIDE OF DIMENSIONS SHOWN.

REPEAT DETAIL AA
SHOWING AREAS OF PLASMA SPRAY APPLICATION.
FIG.405

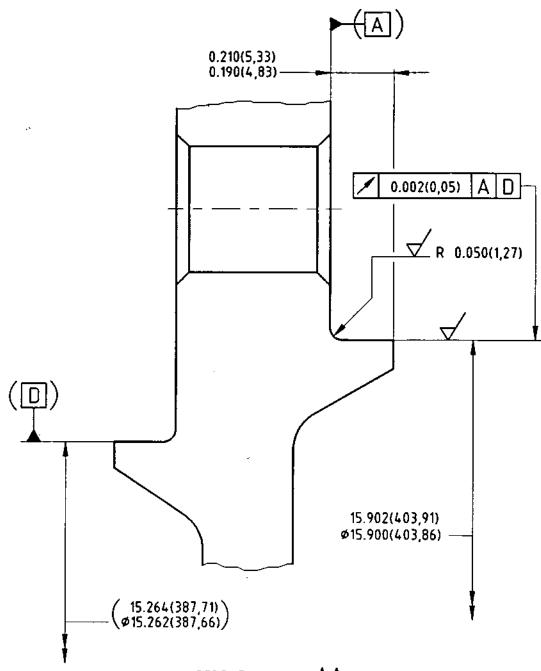
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REPEAT DETAIL AA SHOWING THE PRE-SPRAY MACHINING DIMENSIONS FOR THE REAR LOCATION DIAMETER. FIG.406

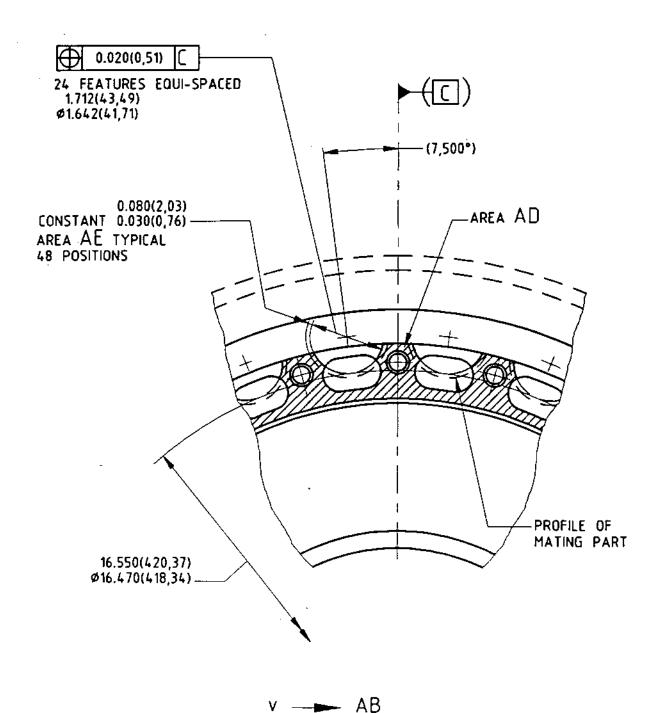
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REPEAT DETAIL AA SHOWING THE FINAL MACHINING DIMENSIONS FOR THE REAR LOCATION DIAMETER. FIG.407

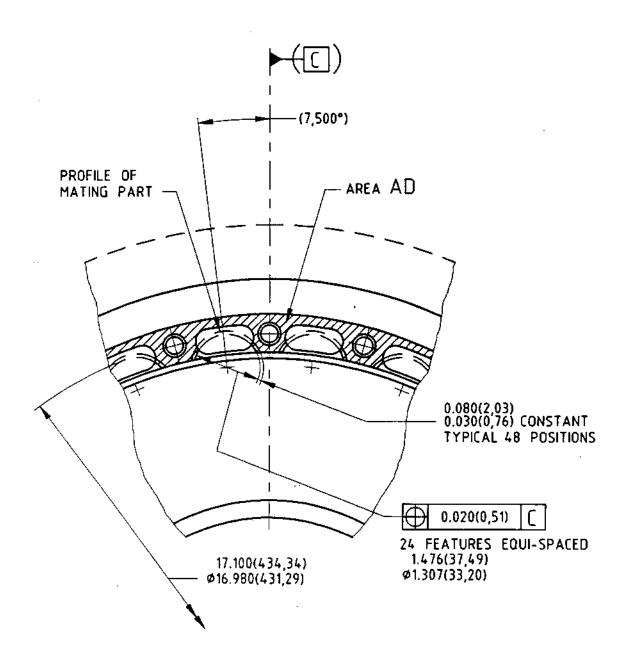
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SHOWING AREA OF PROTECTIVE COATING FIG.408

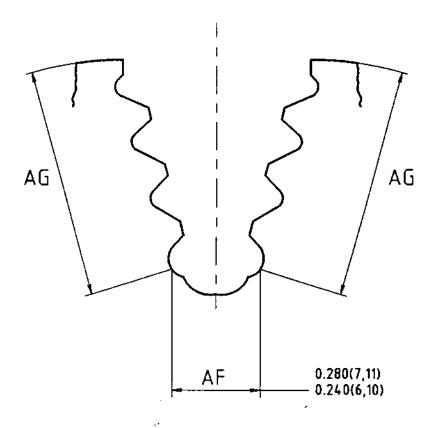
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REPEAT V — AC
SHOWING AREA OF PROTECTIVE COATING
FIG.409

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NOTE: AREA AF TO COVER TOTAL LENGTH OF SLOT.

NO OVERSPRAY IS PERMITTED ON THE
FIR-TREE SLOT AREAS MARKED AG PROTECTIVE
COATING MAY BE BRUSH APPLIED PROVIDED THAT
EVEN COVERAGE AND 'WETTING' IS OBTAINED.

TYPICAL VIEW ON FIR TREE ROOT SLOT SHOWING AREA OF PROTECTIVE COATING FIG.410

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BLADE, COMPRESSOR, HP STAGES 1-3

PROVISION FOR BLADE AEROFOIL TIP DRESSING TO REMOVE BURRS AND/OR HIGH METAL REPAIR NO. B515216-18

1. EFFECTIVITY

| <u>IPC</u> | Fig. | /Item | Part No. |
|------------|------|-------|--|
| 72-33-02 | 1 | 210B | B927482 B927483 B923392 B923393 |
| | | 210c | B929088 B929061 B929062 |
| | | 2100 | B932536 B932528 B932529 |
| | | 210E | B932537 B932532 B932533 |
| | - | 2405 | В932534 В934181 |
| | | 210F | B506863 B506864 B506865 |
| | | | B506866 B506867 B506868 |
| | | | B506869 B506870 B506862 |
| • | | 280A | B506871 B506872 B914356 |
| | | 2004 | B914357 B914550 |
| | | | B914551 B914452 B914453 |
| | | 280B | B913755 B927484 B927485 |
| - | | | B923193 B923194 B923394 |
| | | | B923395 B929091 |

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| <u>IPC</u> | Fig./ | <u>Item</u> | Part No. |
|-------------------|-------|-------------|---|
| 72-33 - 02 | 1 | 280¢ | B929222 B929223 B929220 B929221 B929232 B929239 |
| | | 280D | B929240 B932558 B932584 B932585 B932580 B932581 B935487 B935488 B935488 |
| | | 280E | B935490 B935495 B935767 B935768 B935769 |
| | | 340A | B935770 B935771 B935772 B935773 B935774 B935775 B935776 B935778 B935778 B935780 B935781 B935782 B935783 B935784 B935784 B935785 B935786 B935786 B935786 |
| | | 340B | B913709 B923196 |
| | | 340c | B923195 B927545 B927544 |
| | | 340D | B935488 B929215 B929116 |
| | | 340E | B935495 B932572 B932588 B932592 |

REPAIR

72-33-02
Repair No. 50
Page 402
Jul 31/93



IPC

Fig./Item

Part No.

72-33-02

1 340E

B932589 B932593

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Blending may not be carried out if any of the following defects are present:—

a) Thinning of tip width. (Rounded eroded appearance on the concave side of tip).

b) Blued or burn cratering on areofoil tip.

This Repair Instruction may be embodied any number of times provided that the minimum dimensions stated in figs. 401, 403

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

 Using hand tools only, carefully blend to remove high metal and sharp edges only. Remove the minimum amount of material necessary.

and 405 are not exceeded.

CAUTION: If during metal removal, blending or polishing the material exhibits discolouration due to local overheating, the component must be referred to the local controlling laboratory for assessment.

SUPPLEMENTARY INFORMATION

Refer figs 401 to 406. Refer para.2. REPAIR LIMITATIONS. Refer para.6. DATA.

> REPAIR 72-33-02 Repair No. 50 Page 403 Jul 31/93



2) Dimensionally inspect blade length.

Refer figs.401, 403 and 405.

Locally etch repaired area(s).

Refer Overhaul Manual Chapter 72-09-14 Repair para. J, solution A.

4) Binocular inspect at X15 magnification.

5) Locally crack detect repaired area(s).

Refer Overhaul Manual Chapter 72-33-02 Inspection/check

Locally glass bead peen repair area. Refer Overhaul Manual Chapter 72-09-15 Repair, using process A.

7) Mark Repair Instruction no.
as detailed in table 1 on
component adjacent to normal
'assembly of' number using the
vibro-percussion engraving
technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

TABLE 1

| COMPONENT | IDENTIFICATION MARKING |
|----------------------------|------------------------|
| BLADE, COMPRESSOR, HP ST 1 | B515216 |
| BLADE, COMPRESSOR, HP ST 2 | B515217 |
| BLADE, COMPRESSOR, HP ST 3 | B515218 |

5. MATERIAL

COMPONENT

BLADE, COMPRESSOR, HP
STAGE 1.

BLADE, COMPRESSOR, HP
STAGE 2.

MATERIAL

RR CODE

TAF

IMI 318

MSRR 8610

TDS

IMI 550

MSRR 8642



COMPONENT

MATERIAL

RR CODE

BLADE, COMPRESSOR, HP STAGE 3.

TITANIUM ALLOY IMI 550 MSRR 8642 TDS

6. DATA

The definition of the term HAND TOOLS ONLY is deemed to imply that the following may be used:-

GUN - USHIO AIR TOOL COMPANY Ltd

TYPE MSG-3BSN 65000 R.P.M (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE

TYPE A120 HFX.

NOTE: Load/pressure applied when using the above equipment should not be sufficiently great so as to produce smoking and/or an unpleasant odour from the adhesive agent in the abrasive wheel.

7. <u>TOOLS</u>

TOOL NUMBER

<u>DESCRIPTION</u>

<u>ITEM</u>

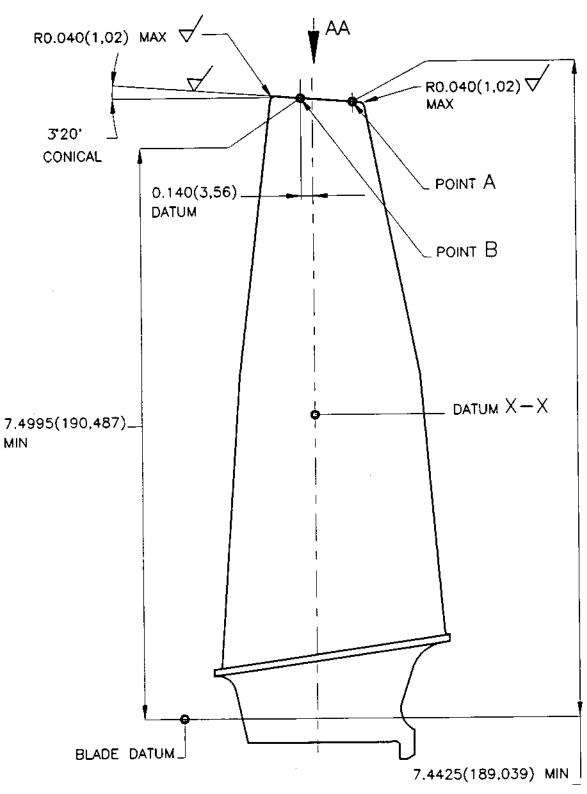
NONE.

8. REPLACEMENT PARTS

NONE.

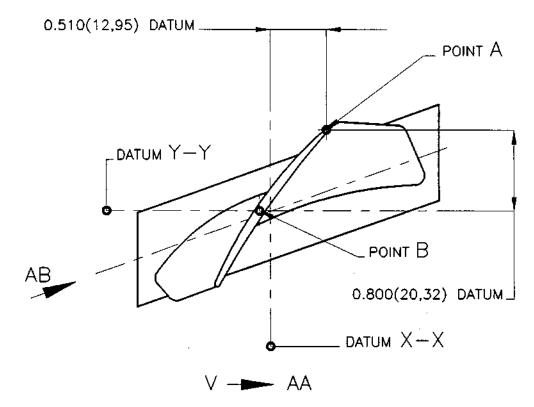
REPAIR
72-33-02
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TYPICAL VIEW OF BLADE, COMPRESSOR HP, STAGE 1. FIG.401

REPAIR 72-33-02 Repair No. 50 Page 406 Jul 31/93



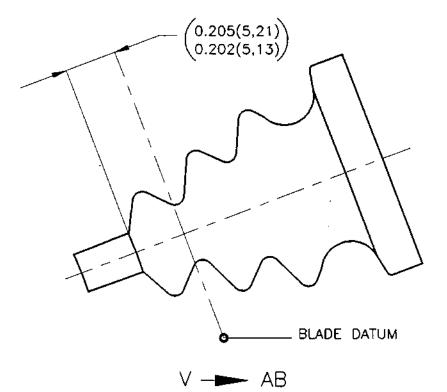
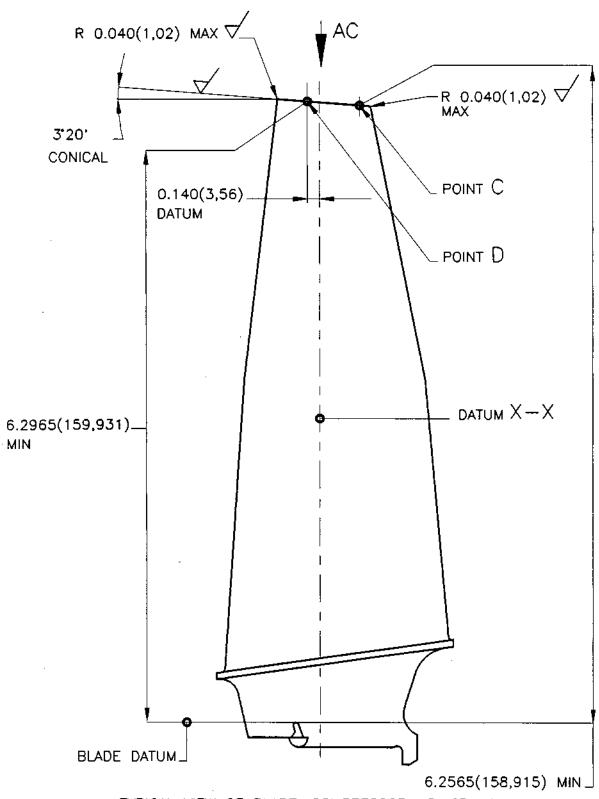


FIG.402

REPAIR 72-33-02 Repair No. 50 Page 407 Jul 31/93

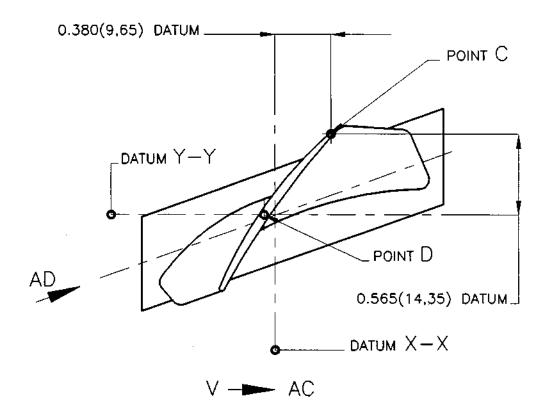


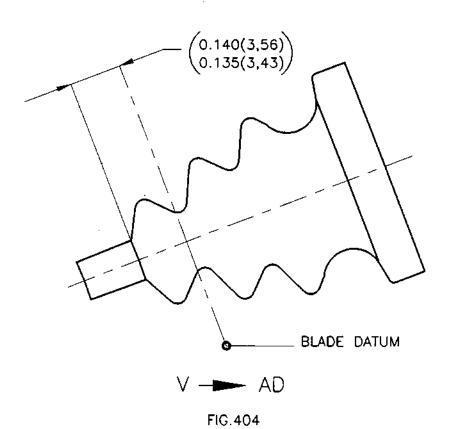


TYPICAL VIEW OF BLADE, COMPRESSOR HP, STAGE 2. FIG.403

REPAIR

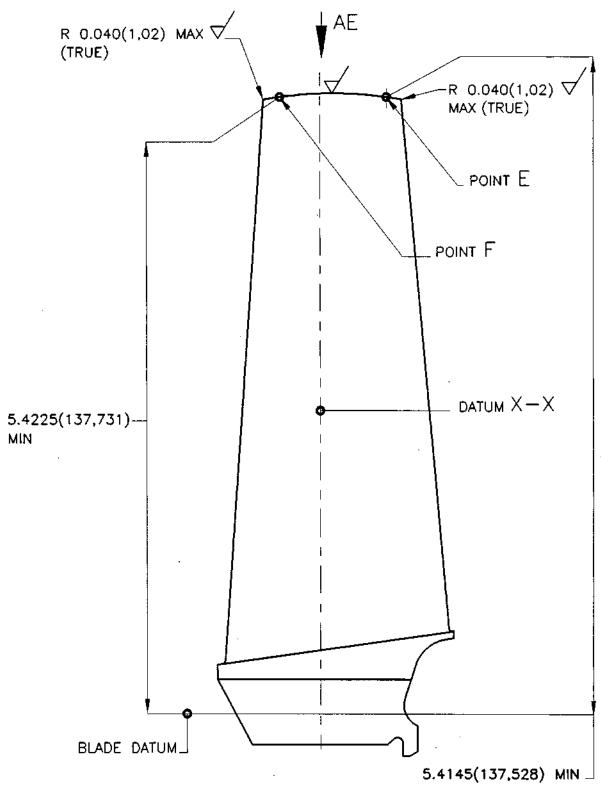
72-33-02 Repair No. 50 Page 408 Jul 31/93





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TYPICAL VIEW OF BLADE, COMPRESSOR HP, STAGE 3. FIG.405

REPAIR

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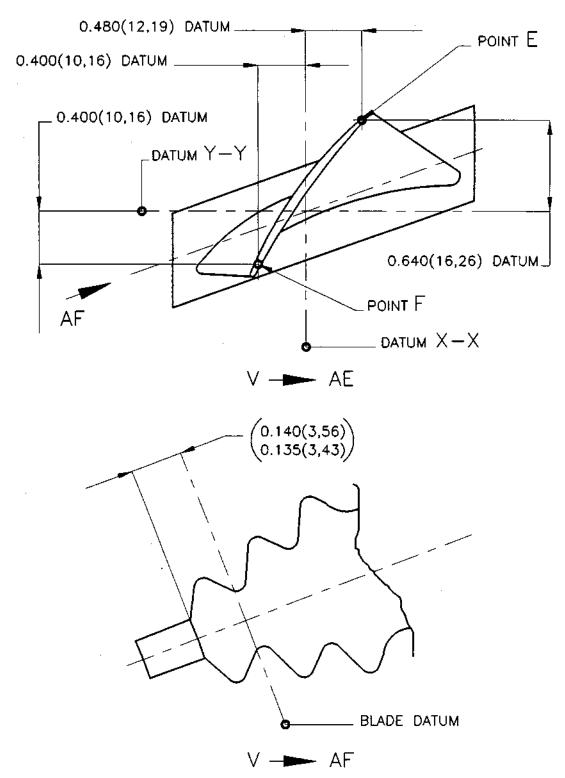


FIG.406

REPAIR 72-33-02 Repair No. 50 Page 411 Jul 31/93



DISK, COMPRESSOR ROTOR, HP STAGE 1

THE BROACHED ROOT FORM, BY BLENDING

REPAIR NO. B515937

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No</u> . |
|------------|------------------|--|
| 72-33-02 | 1 230E | B506873 B506874 B506875 B506876 B506877 B506879 B506880 B506881 B506882 B506883 B506917 B506918 B506920 B506923 |
| | | |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Damage to loaded flanks outside areas B and C (refer fig.401) is not acceptable.

Blend depth maximums are as shown in table 1.

TABLE 1

| Area (refer fig.401) | Maximum blend depth (refer fig's.402 to 404) |
|----------------------|---|
| A | 0.005 (0,13) |

REPAIR



TABLE 1 (CONTINUED)

| Area (refer fig.401) | Maximum blend depth (refer fig's.402 to 404) | | |
|---|---|--|--|
| B and C For C, W max = 0.010 (0,25) | 'W x L' must not exceed 10% of the surface area of loaded flank face. | | |
| D and E (critical areas) | 0.002 (0,05) | | |
| F | Depth S not to exceed 10% of T. | | |
| G . | Any number of platforms may be blended provided the following criteria is achieved. 6 off typical blends maximum not to exceed 10% of outer rim platform at any position. | | |

No blend to extend below XX (refer fig. 402).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Strip anti-fret coating.

Refer Overhaul Manual Chapter 72-09-00 Cleaning Para. 4.D.

72-33-02 Repair No.51 Page 402 Jan 31/94

REPAIR



2) Fluorescent dye penetrant inspect disk. Pay particular attention to the disk root slots.

Refer Overhaul Manual Chapter 72-33-02 Inspection/Check.

3) Hand blend the damaged area(s) to remove damage. Use conventional hand tools and produce radii as required at intersection of blend and flank. When blending area B, the edge between the disk face and the serration must be radiused. The aim is to produce a radiused form, but a chamfer blended at the corners is acceptable, provided that it falls within the dimensions shown in fig's.405 and 406.

Refer fig's.401 to 406. Refer Overhaul Manual Chapter 72-09-22 Repair. Refer para.2. REPAIR LIMITATIONS and para.6. DATA.

CAUTION: If during metal removal, blending or polishing, the material exhibits discolouration due to local overheating, the component must be referred to the local controlling laboratory for assessment by etching and metallurgical examination.

4) Polish blended area(s) to achieve the required surface finish. Area D must only be hand polished using fine grade emery cloth.

Refer fig.401 Use OMat 5/43 or 5/44.

- 5) Locally etch blended area(s).
- 6) Locally dye penetrant inspect repair area(s).
- 7) Vapour blast etched area(s).
- 8) Shot peen surfaces AE and AF, using MI 230 steel shot, intensity 6-10A, coverage 200%.

Refer TSD 594 OP.133

Refer Overhual Manual Chapter 72-33-02 Inspection/Check.

Refer Overhual Manual Chapter 72-09-13 Repair. Use procedure B.

Refer fig's.407 and 408. Refer TSD 594 OP 338.

> REPAIR Repair No.51 Page 403 Jan 31/94

 Pecontaminate disk by glass bead peening, intensity 2N min, 200% coverage. Refer TSD 594 OP 338. Use OMat 1/25 or 1/26.

10) Vapour degrease component.

Refer Overhaul Manual Chapter 72-09-00 Cleaning, Para.5.

11) Wet abrasive blast areas within AF using 320/400 mesh aluminium oxide grit. Use a pressure of 60-80 lbf.in² (414-552 kPa) and a working distance of 4-6 (100-150).

Refer fig.408. Refer Overhaul Manual Chapter 72-09-18 Repair.

Note: Handle component with care in order to avoid contamination of the surfaces to be coated.

Refer fig.408. Use masking tape 0Mat 237 or 0Mat 2/40.

12) Mask off areas not to be coated using masking tape.

Refer fig's.407 and 408. Refer Overhaul Manual Chapter 72-09-18 Repair. Coating PL239 (OMat 4/44).

13) Apply two coats of anti-fret coating to surfaces marked AF by spraying to achieve a finished coating thickness of 0.0001 to 0.0003 (0,003 to 0,008).

Overspray is permissible on surfaces marked AE.

Allow a minimum air drying period of 10 minutes between each coat.

- 14) Remove all traces of masking.
- 15) Stove part at 185 to 195°C (365 to 383°F) for 2 hours.
- 16) Visually inspect coating. The coating should be uniform in colour, smooth, adherent and free from flaking and cracking.
- 17) Mark Repair Instruction number RI B515937 or R51 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique. Markings must be clear of the blade slots by 0.030 (0,75) minimum.

Refer Overhaul Manual Chapter 72-09-00 Repair.

> 72-33-02 Repair No.51 Page 404

REPAIR

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5. MATERIAL

COMPONENT

MATERIAL

RR CODE

DISK, COMPRESSOR ROTOR, HP STAGE 1

TITANIUM MSRR 8634 TCT

6. DATA

> The definition of the term HAND TOOLS ONLY is deemed to imply that the following may be used:-

GUN - USHIO AIR TOOL COMPANY Ltd

TYPE MSG-3BSN 65000 R.P.M (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE

TYPE A120 HFX.

NOTE: - Load/pressure applied when using the above equipment should not be sufficiently great so as to produce smoking and/or an unpleasant odour from the adhesive agent in the abrasive wheel.

7. TOOLS

TOOL NUMBER

<u>DESCRIPTION</u>

ITEM

NONE.

NONE.

8. REPLACEMENT PARTS

PART NUMBER

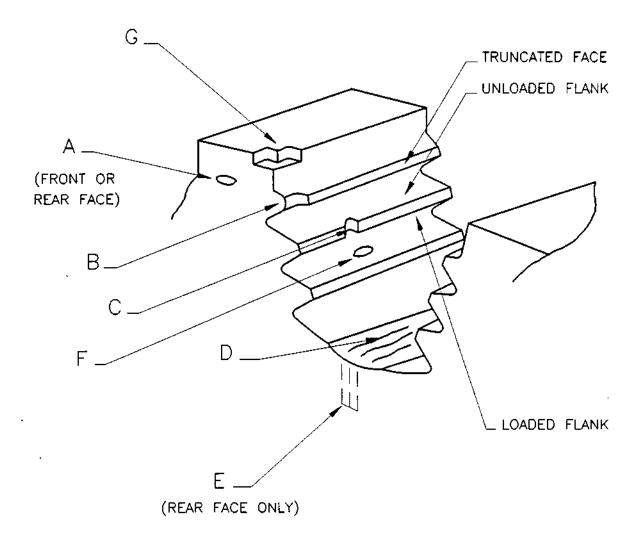
DESCRIPTION

QUANTITY

ITEM

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REPAIR



A SMALL AREAS, LIGHT IMPACT DAMAGE.

B CORNER, LIGHT IMPACT DAMAGE.

C LIGHT IMPACT DAMAGE.

D LIGHT SCRATCHES IN ROOT OR RELIEF, CAUSED BY LOCKING TAG.

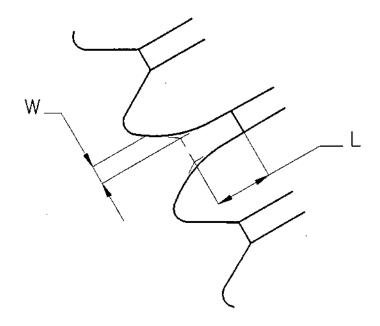
E LIGHT FRET MARKS FROM BLADE TANG.

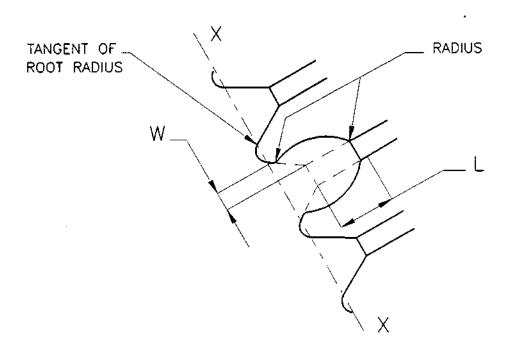
F LIGHT DAMAGE ON UNLOADED FLANK.

G LIGHT IMPACT DAMAGE ON OUTER RIM PLATFORM.

TYPICAL DAMAGE FORMS AND AREAS FIG.401

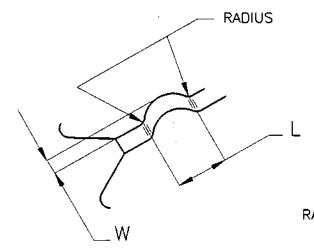
REPAIR 72-33-02 Repair No.51 Page 406 Jan 31/94





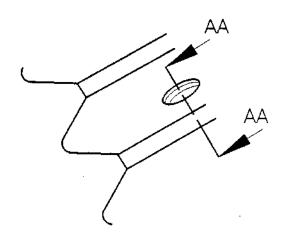
ALTERNATIVE METHODS FOR AREA B FIG. 402

REPAIR **72-33-02** Repair No.51 Page 407 Jan 31/94

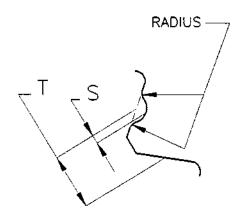


FOR AREA C (REFER FIG.401)

TYPICAL FOR AREAS A AND E (REFER FIG.401)



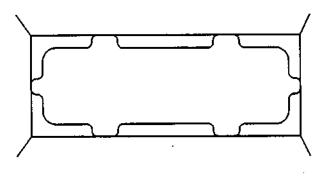
FOR AREA F (REFER FIG.401)



SECTION AA

BLENDING DETAILS FIG.403

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TYPICAL VIEW ON OUTER RIM PLATFORM

FOR AREA G (REFER FIG.401)

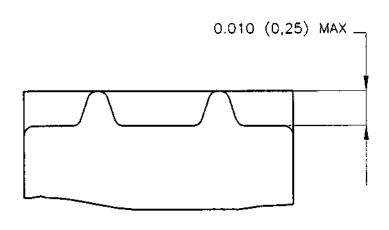
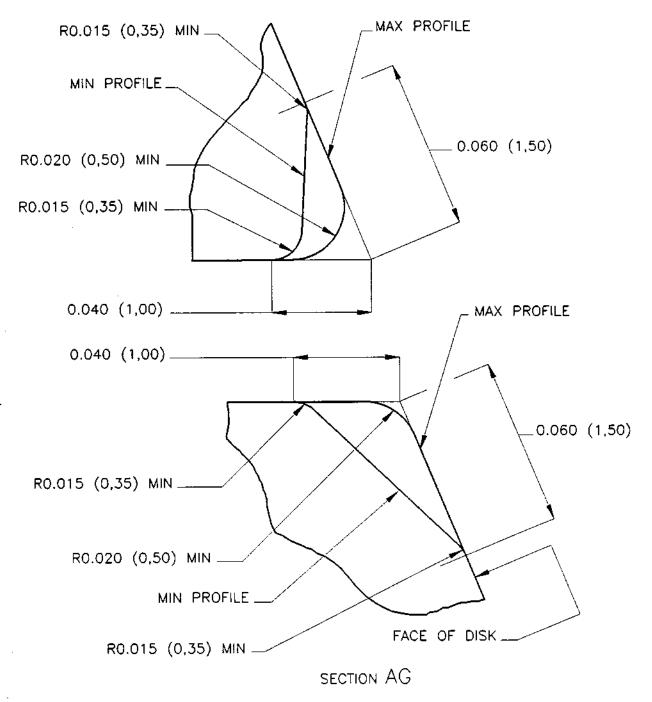




FIG.404

REPAIR 72-33-02 Repair No.51 Page 409 Jan 31/94

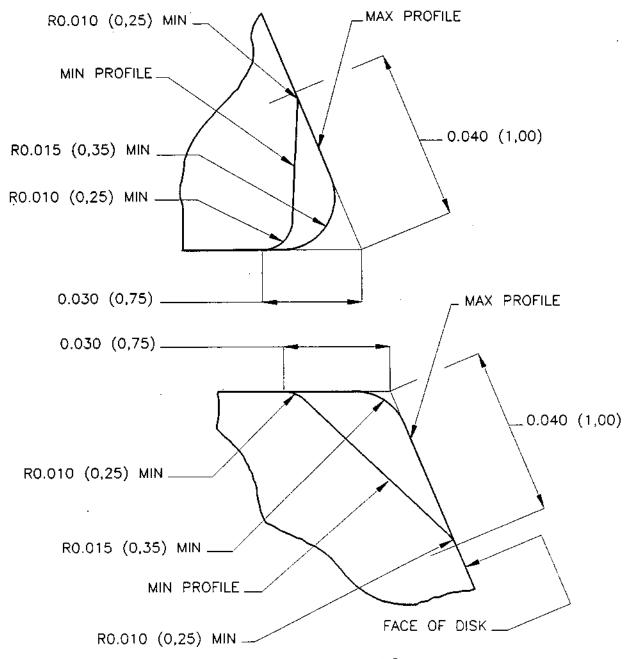


ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN.

FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS 0.035 (0,90) OR MORE FIG.405

REPAIR

72-33-02 Repair No.51 Page 410 Jan 31/94



REPEAT SECTION AG

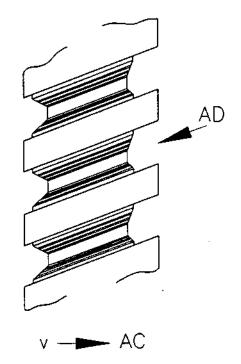
ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN.

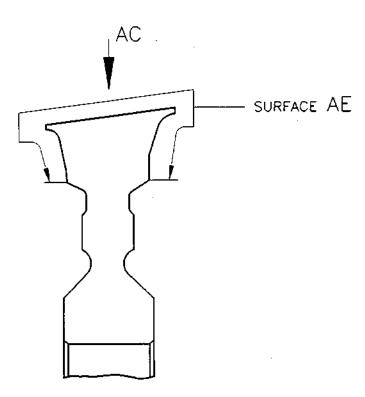
FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS LESS THAN 0.035 (0,90) FIG.406

REPAIR

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Jan 31/94

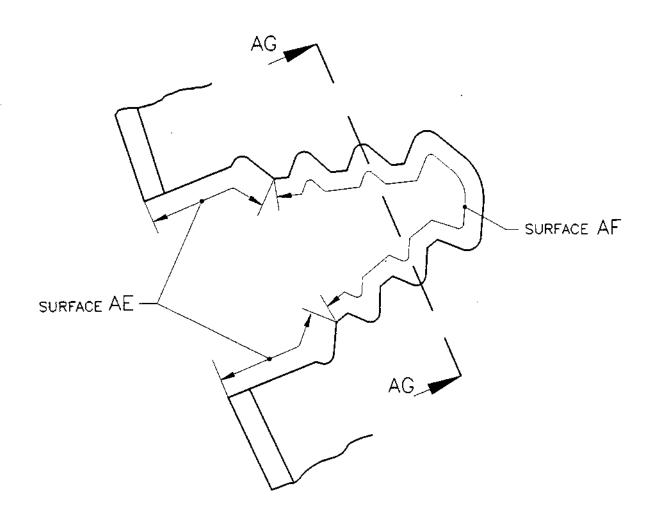






GENERAL SECTION THROUGH DISK FIG.407

REPAIR 72-33-02 Repair No.51 Page 412 Jan 31/94



V — AD

TYPICAL 34 POSITIONS

FIG.408

REPAIR 72-33-02 Repair No.51 Page 413 Jan 31/94



K.OTU-14-28 SNECMA OVERHAUL

RING, SPACER, STAGE 5-6 (H.P.C).

REMOVAL OF LIGHT CORROSION FROM INNER SURFACES AND BOLT HOLES BY BLENDING.

B516402A-B

1. EFFECTIVITY

 IPC
 Fig./Item
 Part No.

 72-33-02
 2/100A
 B922847

 B922848

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

REPAIR LIMITS (Refer Fig. 401).

PART A.

Inner diameter designated 'AA', with corrosion up to 0.003 (0,08) max. deep is acceptable for repair (This part of the Repair Instruction may be carried out ONCE only).

PART B.

Bolts holes designated 'AB', with corrosion to a maximum depth of 0.004(0,10) for up to 50% of hole circumference, may be blended to a maximum depth of 0.005(0,13). (For re-application of this part of the Repair Instruction the total blend depth shall not exceed the limits stated above).

3. **GENERAL**

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES16D)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR 72-33-02 Repair No. 52 Page 401 Sep 30/94

SUPPLEMENTARY INFORMATION

1) Using hand tools only and abrasive mat or fine grade abrasive papers/cloth, lightly blend to remove corrosion from inner diameter AA and/or bolt holes AB.

Refer Fig.401. Refer para.2 Repair limits. Refer para.6 Data. Use OMat 583 or 5/44.

2) Locally etch repair area.

Refer Overhaul Manual Chapter 72-09-14 Repair, using Solution C.

- 3) Binocular inspect at X10 magnification.
- 4) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210

5) Vapour blast repair area.

Refer Overhaul Manual Chapter 72-09-13 Repair.

6) Mark Repair Instruction number RI B516402A or R52A (Part A) RI B516402B or R52B (Part B) on component, within area AC, using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.401. Refer para.2 Repair limits.

MATÉRIAL

COMPONENT

MATERIAL

RR CODE

RING, SPACER, STAGE 5-6 (H.P.C).

WASPALOY MSRR 7034 QDY

6. DATA

THE DEFINITION OF THE TERM HAND TOOLS ONLY IS DEEMED TO IMPLY THAT THE FOLLOWING MAY BE USED.

GUN - USHIO AIR TOOL COMPANY LTD.

TYPE MSG-3BSN 65000 R.P.M. (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE

TYPE A120 HFX.

NOTE: LOAD/PRESSURE APPLIED WHEN USING THE ABOVE EQUIPMENT SHOULD NOT BE SUFFICIENTLY GREAT SO AS TO PRODUCE SMOKING AND/OR AN UNPLEASANT ODOUR FROM THE ADHESIVE AGENT IN THE ABRASIVE WHEEL.

7. TOOLS

TOOL NUMBER DESCRIPTION

ITEM

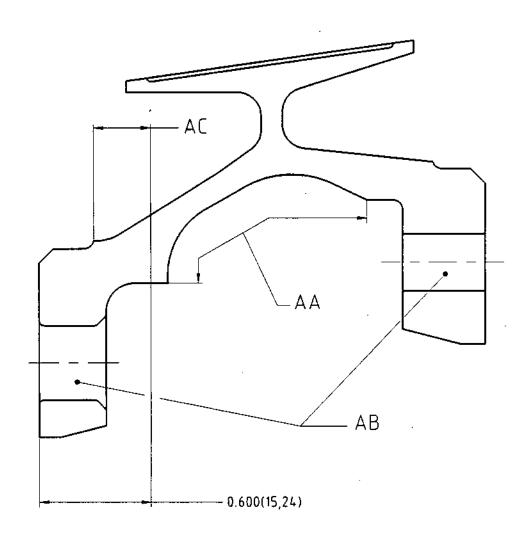
NONE.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.





TYPICAL SECTION THROUGH SPACER FIG.401

72-33-02 Repair No. 52 Page 404 Sep 30/94



RING, SPACER, STAGE 6-7 (H.P.C).

REMOVAL OF LIGHT CORROSION FROM INNER SURFACES BY POLISHING.

B516413

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|--------------------|
| 72-33-02 | 1/390A | B922851 |
| | | B922852 B922853 |
| | | B922854 |
| | | B922855 B922856 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be carried out ONCE only.

REPAIR LIMITS (refer fig.401).

Inner diameter designated 'AA', with corrosion up to 0.002 (0,05) max. deep is acceptable for repair

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR 72-33-02 Repair No. 53 Page 401 Sep 30/94 MK.610-14-28 snecma OVERHAUL

| 4. | REPAIR PROCEDURE | SUPPLEME | ENTARY INFORMATION |
|----|--|-------------------------------|--|
| 1) | Using hand tools only and abrasive mat or fine grade abrasive papers/cloth, ligh polish to remove corrosion from inner diameter AA. | tly Refer pa | ig.401. ara.2 Repair limits. ara.6 Data. t 583 or 5/44. |
| 2) | Visually inspect repair are | a. | |
| 3) | Locally etch repair area. | Chapter | verhaul Manual 72-09-14 Repair, olution C. |
| 4) | Binocular inspect at X10 magnification. | | |
| 5) | Locally dye penetrant insperepair area. | ct Refer TS | SD 594 OP.210 |
| 6) | Vapour blast repair area. | | verhaul Manual 72-09-13 Repair. |
| 7) | Mark Repair Instruction num RI B516413 or R53 on compon adjacent to normal 'assembl number, using the vibropercussion engraving techni | ent, Chapter y of Refer Fi | verhaul Manual 72-09-00 Repair. ig.401. |
| 5. | MATERIAL | | |
| | COMPONENT | MATERIAL | RR CODE |
| | RING, SPACER, STAGE 6-7 (H.P.C). | WASPALOY MSRR 7034 | QDY |

6. DATA

THE DEFINITION OF THE TERM HAND TOOLS ONLY IS DEEMED TO IMPLY THAT THE FOLLOWING MAY BE USED.

GUN - USHIO AIR TOOL COMPANY LTD.

TYPE MSG-3BSN 65000 R.P.M. (6 BAR AIR PRESSURE).

WHEEL - MASTER ABRASIVE

TYPE A120 HFX.

NOTE: LOAD/PRESSURE APPLIED WHEN USING THE ABOVE EQUIPMENT SHOULD NOT BE SUFFICIENTLY GREAT SO AS TO PRODUCE SMOKING AND/OR AN UNPLEASANT ODOUR FROM THE ADHESIVE AGENT IN THE ABRASIVE WHEEL.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

NONE.

8. REPLACEMENT PARTS

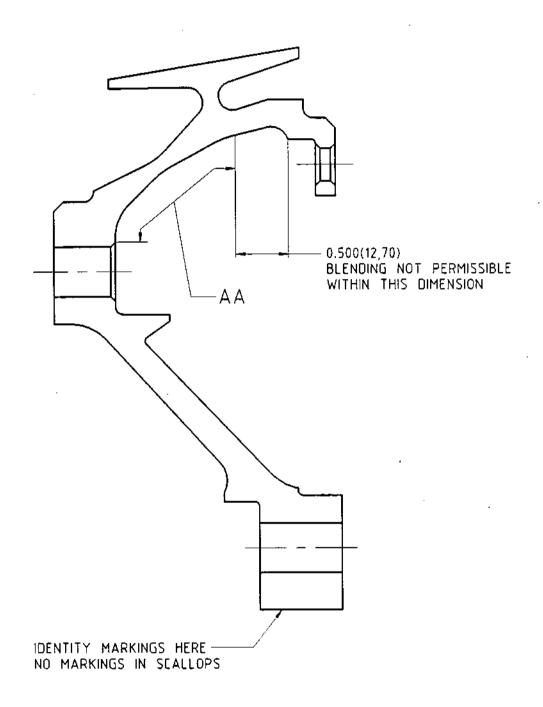
PART NUMBER

DESCRIPTION

QUANTITY

ITEM





TYPICAL SECTION THROUGH SPACER FIG.401

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RING, SPACER, STAGE 3-4 (H.P.C).

PROVISION FOR THE RESTORATION OF THE FRONT AND REAR LOCATION DIAMETERS BY PLASMA SPRAYING.

B516405A-B

1. EFFECTIVITY

<u>IPC</u> <u>Fig./Item</u> <u>Part No.</u>
72-33-02 1/380A B922839
B922840

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

CAUTION: Repair Instructions B516405A and B516405B are only to be used individually and must not be applied simultaneously or a loss of datums will result.

Repair Instruction B516405A: Restoration of the front location diameter.

Repair Instruction B516405B: Restoration of the rear location diameter.

Bolt hole P.C.D.'s must lie within drawing requirements prior to commencement of repairs (Refer to Fig. 401).

Geometric tolerances and dimensions apply in the restrained state.

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

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4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

B516405A: Restoration of front location diameter.

 Dimensionally inspect the bolt hole pitch circle diameters. Refer Fig. 401.
Refer Repair Limitations.

 Load component to machine and set true to datums A and C. Refer Fig. 401.

Machine the front location diameter.

Refer Fig. 401.
Refer para. 6. Data.

- 4) Remove component from machine.
- 5) Deburr component.

Dimensionally inspect.

Refer Fig. 401.

7) Locally etch repaired area to ensure complete removal of coating (Repeat repairs only) Refer TSD 594 OP.214

8) Locally dye penetrant inspect repair area.

Refer TSD 594 0P.210

9) Mask off all areas except areas marked AB.

Refer TSD 594 OP.704 Refer Fig.403.

10) Abrasive blast area marked AB.

Refer TSD 594 OP.704 Refer fig.403.

Plasma spray coating on area marked AB.
Apply coating to a sufficient thickness to achieve final dimensions.

Refer TSD 594 OP.704 Use OMat 3/179. Refer fig.403.

Visually inspect coating for evidence of blistering, lifting, cracking or chipping.

11) Dimensionally inspect.

Refer Fig. 403.

- 12) Remove masking from component.
- 13) Load component to machine and set true to datums A and C.

Refer Fig. 402.

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14) Machine the front location diameter to the post spray dimensions. Refer Fig. 402. Refer para.6. Data.

- 15) Remove component from machine.
- 16) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.

Refer TSD 594 OP.704

17) Mark Repair Instruction number RI B516405A or R54A and coating identity symbol on component, within area AA, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig. 402.

Coating symbol



B516405B: Restoration of rear location diameter.

 Dimensionally inspect the bolt hole pitch circle diameters.

Refer Fig. 401.
Refer Repair Limitations.

Load component to machine and set true to datums A and B. Refer Fig. 404.

Machine the rear location diameter.

Refer Fig. 404. Refer para.6. Data.

- 4) Remove component from machine.
- 5) Deburr component.
- 6) Dimensionally inspect.

Refer Fig. 404.

7) Locally etch repaired area to ensure complete removal of coating (Repeat repairs only)

Refer TSD 594 OP.214

8) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210

 Mask off all areas except areas marked AC. Refer TSD 594 OP.704 Refer Fig. 403.

■ 10) Abrasive blast area marked AC.

Refer TSD 594 OP.704 Refer fig.403.

Plasma spray coating on area marked AC.
Apply coating to a sufficient thickness to achieve final

Refer TSD 594 0P.704 Use OMat 3/179. Refer fig.403.

Visually inspect coating for evidence of blistering, lifting, cracking or chipping.

11) Dimensionally inspect.

dimensions.

Refer Fig. 403.

12) Remove masking from component.

■ 13) Load component to machine and set true to datums A and B. Refer Fig. 405.

14) Machine the rear location diameter to the post spray dimensions.

Refer Fig. 405. Refer para. 6. Data.

■ 15) Remove component from machine.

16) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.

Refer TSD 594 OP.704

17) Mark Repair Instruction number RI B516405B or R54B and coating identity symbol on component, within area AA, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.405.

Coating symbol HA

5. MATERIAL

COMPONENT

MATERIAL.

RR CODE

RING, SPACER, STAGE 3-4 (H.P.C).

WASPALOY MSRR 7034 QDY

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6. DATA

PRE-SPRAY MACHINING DETAILS.

Tool: Carbide ISO KO5/k10. Lubricant: G.P soluble oil.

Speed: 12.5 RPM.

Feed: 0.004(0,1)/REV.

Depth of cut: 0.006(0,15) Min.

POST SPRAY MACHINING DETAILS.

Tool: ISO K range.

Lubricant: G.P soluble oil.

Speed: 25-30 RPM.

Feed: Manual.

7. . TOOLS

TOOL NUMBER DESCRIPTION

ITEM

NONE.

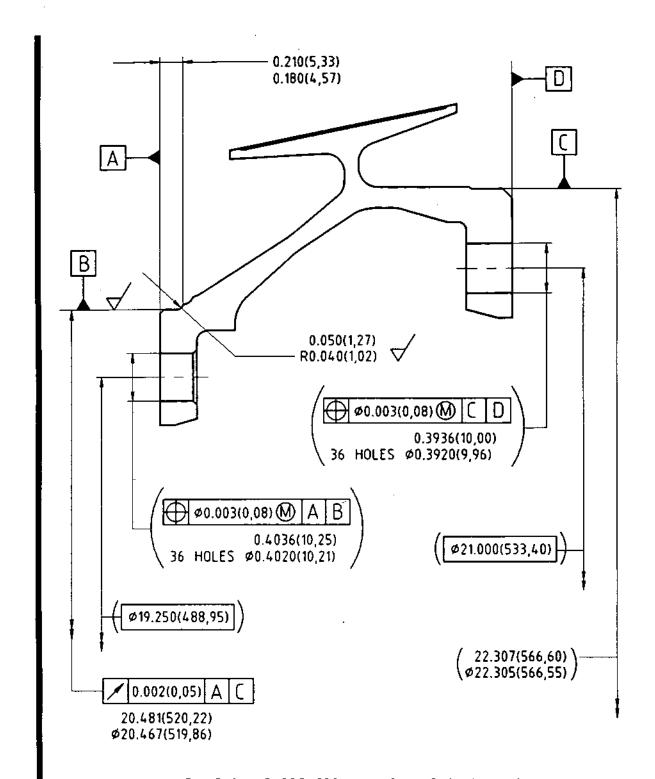
8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.

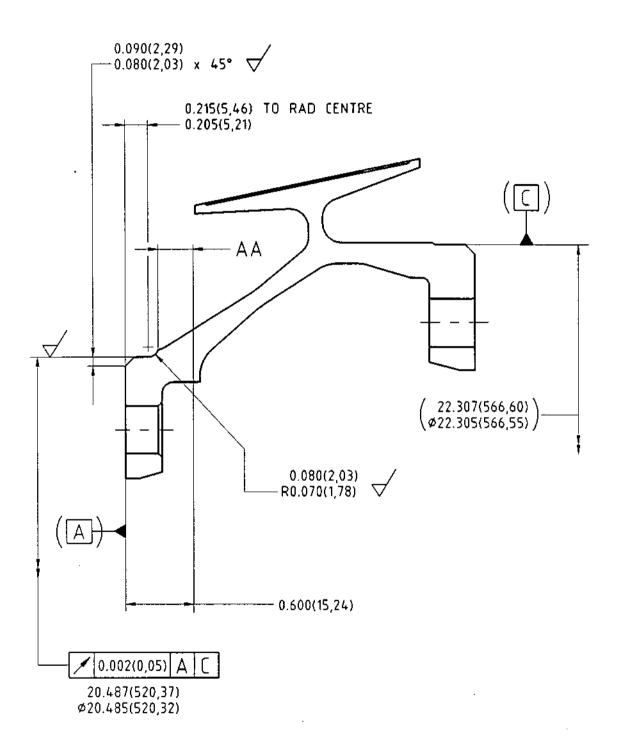
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VIEW SHOWING PRE SPRAY MACHINING DIMENSIONS FOR THE FRONT LOCATION DIAMETER FIG.401.

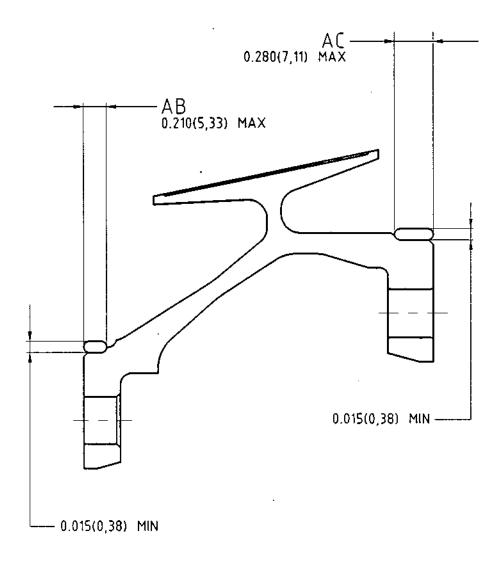
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VIEW SHOWING FINAL MACHINING DIMENSIONS FOR THE FRONT LOCATION DIAMETER FIG.402

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NOTE: OVERSPRAY IS NOT PERMITTED OUTSIDE OF THE DIMENSIONS SHOWN.

PLASMA SPRAY AREAS WITHIN AB AND AC.

VIEW SHOWING AREAS OF PLASMA SPRAY APPLICATION FIG.403

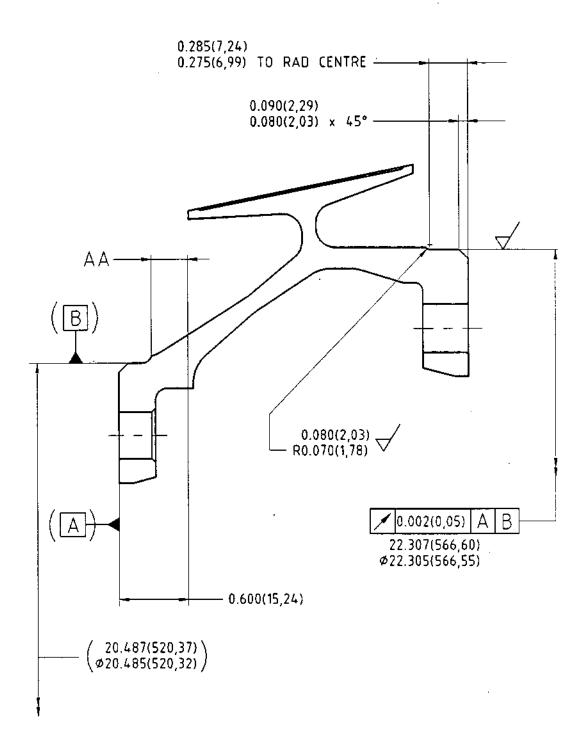
REPAIR 72-33-02 Repair No. 54 Page 408 Sep 30/94

0.280(7,11) 0.250(6,35) В 0.050(1,27) R0.040(1,02) 0.002(0,05) A 22.301(566,45) Ø22.297(566,34) (20.487(520,37) Ø20.485(520,32)

> VIEW SHOWING PRE SPRAY MACHINING DIMENSIONS FOR THE REAR LOCATION DIAMETER FIG.404

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VIEW SHOWING FINAL MACHINING DIMENSIONS FOR THE REAR LOCATION DIAMETER FIG. 405

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LABYRINTH, No.12

REMOVAL OF LIGHT CORROSION FROM INNER SURFACES BY POLISHING.

B516644

1. EFFECTIVITY

| IPC | Fig./Item | <u>Part No.</u> |
|----------|-----------|--------------------|
| 72-33-02 | 3/300A | B922878 B922879 |
| | 3A/300B | B925369 B930196 |
| | 3A/300C | B929466 B929467 |
| | | 8933206 8933207 |
| | 3A/300D | 8512228 8512229 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be applied a maximum 5 times, provided the minimum wall section of 0.100(2,54) is maintained (Refer Fig. 401).

REPAIR LIMITS (Refer Fig. 401).

Inner diameter designated 'AA', with corrosion up to 0.002 (0.05) max. deep, is acceptable for repair

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
-3rd Angle Projection

REPAIR

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| 4. | RFPAIR | PROCEDURE PROCEDURE | |
|-----|----------------|----------------------|--|
| ₹ 6 | 17 - 1 - 1 - 1 | 1 11 0 0 E P O I 1 E | |

- Using hand tools only and abrasive mat or fine grade abrasive papers/cloth, lightly polish to remove corrosion from inner diameter AA.
- 2) Visually inspect repair area.
- Locally etch repair area.
- 4) Binocular inspect at X10 magnification.
- 5) Locally dye penetrant inspect repair area.
- Locally vapour blast repair area.
- 7) Mark Repair Instruction number RI B516644 or R55 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

SUPPLEMENTARY INFORMATION

Refer Fig.401.
Refer para.2. Repair limits.
Refer Overhaul Manual
Chapter 72-09-22 Repair,
Use OMat 583 or 5/44.

Refer Overhaul Manual Chapter 72-09-14 Repair, using Solution C.

Refer TSD 594 0P.210

Refer Overhaul Manual Chapter 72-09-13 Repair.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.401.

5. MATERIAL

COMPONENT MATERIAL RR CODE

LABYRINTH, No.12 WASPALOY
MSRR 7034

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

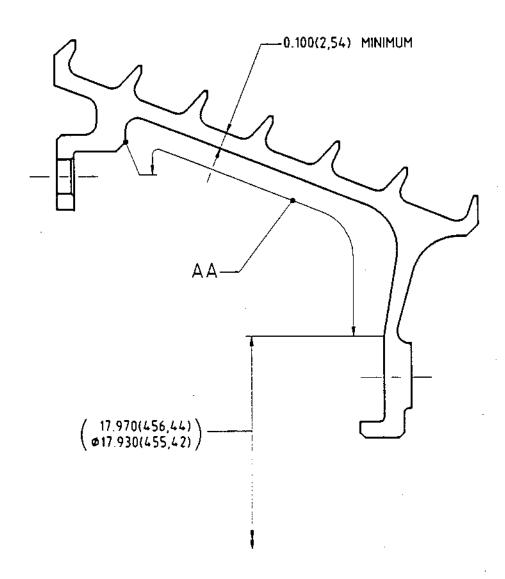
NONE.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.

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VIEW SHOWING AREA OF BLENDING. FIG.401.

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SHAFT, DRIVE, COMPRESSOR HP THE BLENDING OF DAMAGE ON THE BOLT LOCATING DIAMETER B517751

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | Part No. |
|------------|------------------|--|
| 72-33-02 | 3/3308 | B923990-91 B925461-62 B935451-55 |
| | 3/330D | B512232-39 |
| | 3/330E | B517189-99 B517200 |
| | 3/330F | B517201-12 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this Repair Process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This instruction gives the procedure for the blending of damage on the bolt locating diameter on the Shaft, Drive, Compressor HP.

Source demonstration is not necessary for this repair.

This instruction may be applied any number of times provided that the maximum residual depth of damage does not exceed 0.024 (0,61) after removal of high metal.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

REPAIR

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4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Visually inspect to establish areas of damage.
- 2) Blend to remove damage.

Refer Overhaul Manual Chapter 72-09-22 Repair. Use hand tools only. Refer Fig. 401.

- 3) Remove sharp edges.
- 4) Polish blended areas to achieve surface finish same as adjacent material.
- 5) Locally etch repair area.

Refer to TASK 70-00-00-200-214. SUBTASK 70-00-00-110-214-A01.

6) Examine repair area using binoculars.

Use X7 magnification. Reject if cracked.

7) Locally dye penetrant inspect repair area.

Refer to TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002 Use OMat 653. Cracks are not permitted.

8) Locally vapour blast repair area.

Refer to TASK 70-00-00-300-338. ALMEN intensity 2N min. Coverage 200 percent. OMat 1/244 abrasive medium.

9) Mark Repair Instruction Number RI 517751 or R56 adjacent part number. Refer to TASK 70-00-00-300-363 SUBTASK 70-00-00-180-363-027. Use vibration peen equipment.



5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u>

AFT, DRIVE, WASPALOY QDY

SHAFT, DRIVE, COMPRESSOR HP

6. DATA

NONE.

7. TOOLS

TOOL NUMBER DESCRIPTION ITEM

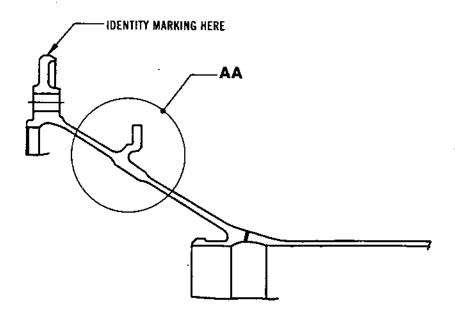
NONE.

8. REPLACEMENT PARTS

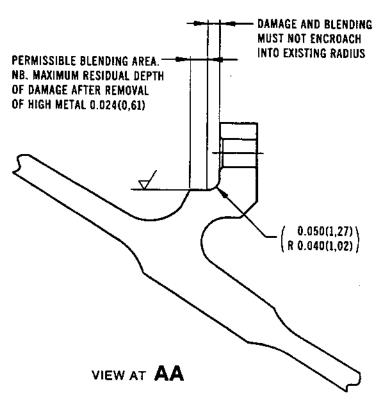
PART NO. DESCRIPTION QUANTITY ITEM

NONE.

RR CODE



TYPICAL SECTION THROUGH DRIVESHAFT



HP Compressor Drive Shaft Bolt Location Details Figure 401

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SHAFT, DRIVE, COMPRESSOR HP REMOVE FRETTING/CORROSION FROM NO.4 BEARING INNER RACE ABUTMENT SHOULDER B517804

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | Part No. |
|------------|-----------|--|
| 72-33-02 | 3/330B | B923990-91 B925461-62 B935451-55 |
| | 3/3300 | B512232-39 |
| | 3/330E | B517189-99 B517200 |
| | 3/330F | B517201-12 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this Repair Process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This instruction gives the procedure for skim grinding to remove fretting/corrosion from No.4 Bearing inner race abutment shoulder on the Shaft, Drive, Compressor HP.

Source demonstration is not necessary for this repair.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

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4. REPAIR PROCEDURE

- Install component in grinding machine and set true to datums.
- 2) Skim grind damaged No.4 bearing inner race abutment shoulder face to clean-up only, blending with existing corner radius and datum A diameter.

SUPPLEMENTARY INFORMATION

Refer Figs. 401 and 402.

Refer Figs.401 and 402.

Grinding data: Wheel

: A60JV

Grit size 46-80

Grade I-K

Lubricant: Translucent

soluble oil

Depth of

: 0.0002 (0,005) cut

/rev. maximum

Speed

: 35 m/s

Feed Speed : Hand

: 50-60 RPM

(Component)

- 3) Remove sharp edges.
- 4) Do a dimensional inspection of component.
- Locally etch repair area. 5)
- Examine repair area using 6) binoculars.
- 7) Locally dye penetrant inspect repair area.
- Locally vapour blast repair 8) area.
- 9) Mark Repair Instruction Number RI 517751 or R57 adjacent part number.

Refer Figs. 401 and 402.

Refer to TASK 70-00-00-200-214

SUBTASK 70-00-00-110-214-A01.

Use X7 magnification. Reject if cracked.

Refer to

TASK 70-00-00-200-210

SUBTASK 70-00-00-230-210-002.

Use OMat 652.

Cracks are not permitted.

Refer to

TASK 70-00-00-300-338

SUBTASK 70-00-00-120-338-001.

ALMEN intensity 2N min. Coverage 200 percent. OMat 1/244 abrasive

medium.

Refer to

TASK 70-00-00-300-363

SUBTASK 70-00-00-180-363-027.

Use vibration peen equipment.

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5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u> <u>RR CODE</u>

SHAFT, DRIVE, WASPALOY QDY

HPC

6. DATA

NONE.

7. <u>TOOLS</u>

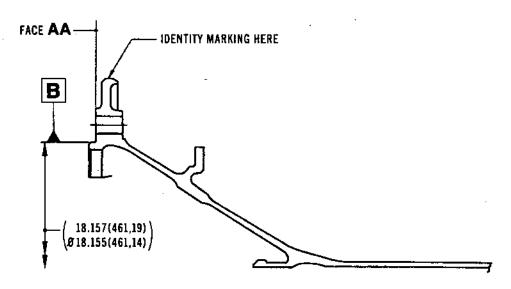
TOOL NUMBER DESCRIPTION ITEM

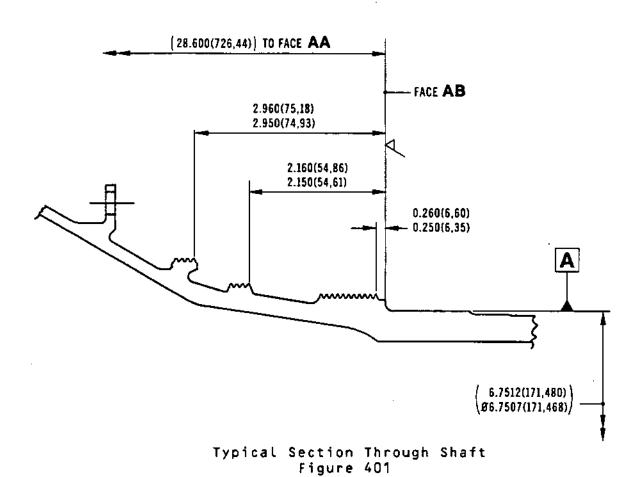
NONE.

8. REPLACEMENT PARTS

PART NO. DESCRIPTION QUANTITY ITEM

NONE.

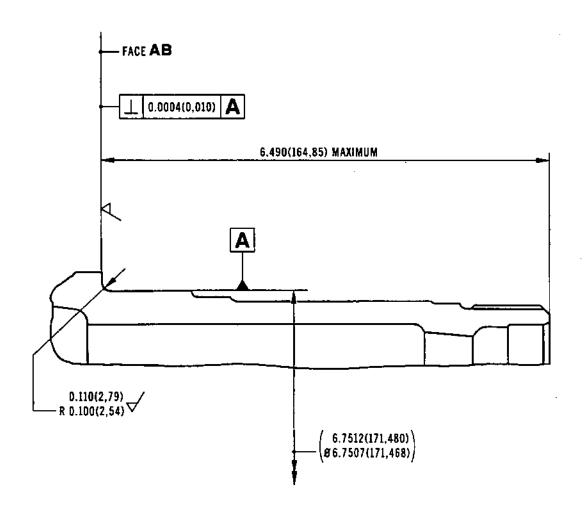




72-33-02 Repair No.57

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BS00016735/1



Typical Section Through Shaft Figure 402

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RING, SPACER, STAGE 3-4 (H.P.C.) REMOVE CORROSION FROM BORE BY HAND DRESSING B517809

1. EFFECTIVITY

IPC Fig./Item Part No.

72-33-02 1/380A 8922839 8922840

2. REPAIR LIMITATIONS

Compliance with all aspects of this Repair Process shall be achieved without deviation. Where a need to deviate is considered necessary, reference shall be made to the Repair Authority for agreement.

This instruction gives the procedure for the removal of corrosion from bore by hand dressing from Ring, Spacer, stage 3-4 (H.P.C).

Source demonstration is not necessary for this repair.

Corrosion up to 0.005 (0,127) maximum depth is acceptable for repair within areas shown. (Refer to Fig. 401).

Remove twice the measured depth of corrosion.

For re-application of Repair Instruction, a total blend depth shall not exceed the limits quoted.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

ALL TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

REPAIR

/2-33-02 Repair No.58 Page 401

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4. REPAIR PROCEDURE

- Remove corrosion (Descale).
- 2) Use hand tools or fine grade abrasive to lightly polish to remove corrosion from bore. Remove a minimum amount of material to produce a smooth and continuous profile.
- 3) Visually inspect the component.
- 4) Locally etch repair area.
- 5) Examine repair area using binoculars.
- 6) Locally dye penetrant inspect repair area.
- Locally vapour blast repair area.
- 8) Mark Repair Instruction Number RI 517809 or R58 adjacent part number.

SUPPLEMENTARY INFORMATION

Refer Overhaul Manual 72-09-00 Cleaning. Use Process L.

Refer Overhaul Manual 72-09-22 Repair. Use OMat 583 or 5/44. Refer to General Data. Refer Fig.401.

Refer Fig. 401.

Refer to TASK 70-00-00-200-214 SUBTASK 70-00-00-110-214-A01.

Use X10 magnification. Reject if cracked.

Refer to TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002. Use OMat 652. Cracks are not permitted.

Refer to TASK 70-00-00-300-338 SUBTASK 70-00-00-120-338-001. ALMEN intensity 2N min. Coverage 200 percent. OMat 1/244 abrasive medium.

Refer to TASK 70-00-00-300-338 SUBTASK 70-00-00-180-363-027. Use vibration peen equipment.

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5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u>

RR CODE

RING, SPACER, STAGE 3-4 (H.P.C.) MSRR7D34 Waspaloy QDY

6. DATA

NONE.

7. TOOLS

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

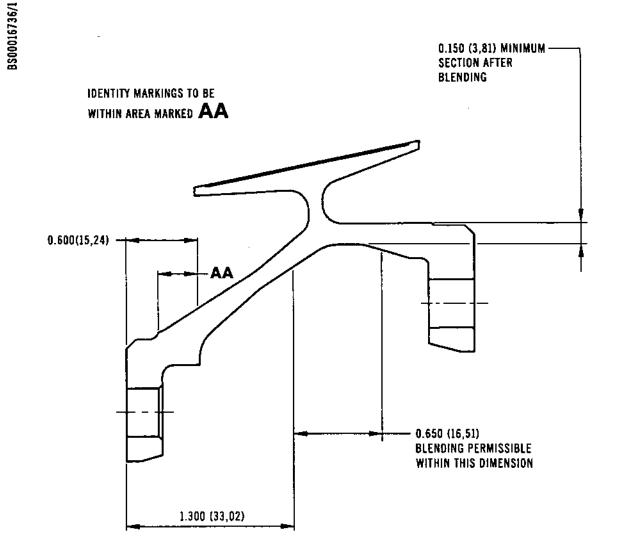
PART NO.

DESCRIPTION

QUANTITY

ITEM

NONE.



Typical Section Through Spacer (Taken Through Bolt Holes) Figure 401

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CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-509

Insert in 72-33-02 at rear of repair section in RST No. order

REASON FOR ISSUE:

Air transfer tube P/No's.B922599, B922557. To introduce a repair scheme to restore the worn bell-end bore (MRA 57).

ACTION

Add operation 8 to Procedure on Sheet 1 to read:-

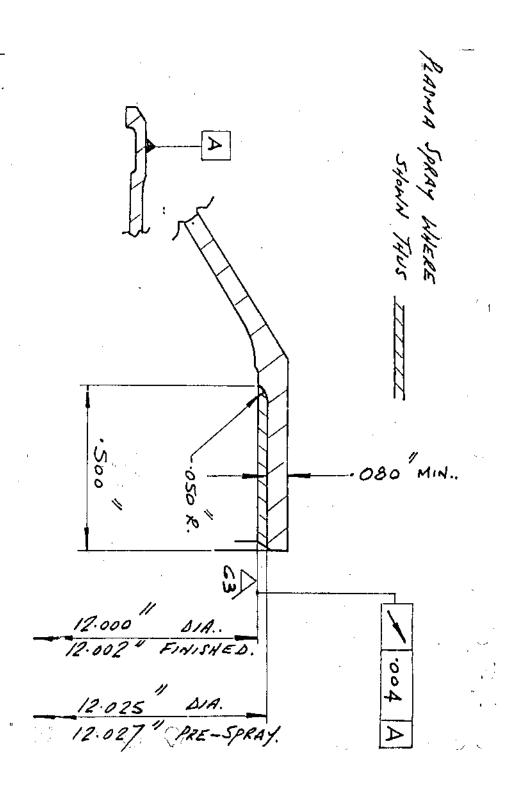
Reidentify in accordance with Modification 72-8255-160.

B.E.O.L. REPAIR - RST 4000 Air Transfer Tube: Restore worn Bell-End bore diameter by Plasma spray.

PROCEDURE

- 1. Set running true to datum 'A'.
- Open up bore to 12.025"/12.027" as shown. Observe .080" min. wall thickness.
- 3. Prepare and Plasma Spray bore per T.S.D.594-704. Apply a Metco 450 bond coat .004/.005" thick followed by a final coat of Metco 45C-NS .010"/.012" thick.
- 4. Set up as in Opn.1 and machine to produce a final bore size of 12.000"/12.002" dia. as shown.
- Inspect coating for cracks and adhesion per TSD.594-704.
- 6. Vibro-engrave R.S.T.4000 adjacent to P/No.
- 7. Finally inspect.
- 8. Re-identify in accordance with Modification 72-8255-160.

TEMPORARY REVISION No. 72-509



TR.72-509 72-33-02 TR Page 2 of 2 RST 4000

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-535

Insert in 72-33-02 at rear of repair section in RST No. order

REASON FOR ISSUE:

To introduce a repair for restoration of Rokide A coating on H.P. compressor spacer ring. (MRA 104)

ACTION

B.E.O.L. REPAIR

RST 4020 H.P. COMPRESSOR SPACER RING STGS:- 3-4, 4-5, 5-6 & 6-7. - PLASMA SPRAY.

PROCEDURE: -

- 1. Degrease using trichlorethylene vapour.
- 2. Mask areas that do not require coating.
- Abrasive blast to remove rokide 'A' coating leaving bond coat intact - (indicated by colour change), as per Vol.4, Section 72-09-24.
- 4. Plasma spray using MSRR 9507/9 Alumina powder (Metco 105-NS) coating, as per T.S.D. 594 Op. 704.
- 5. Finish machine to final dimensions, & use following parameters:-

Tool - Standard Diamond.

Coolant - None - Machine dry, use extraction

equipment.

Speed - 31½ R.P.M.

Feed - 0.030 Ins/Rev.

- Inspect coating for cracking & adhesion as per T.S.D. 594 Op. 704.
- 7. Final Inspect.
- 8. Vibro engrave RST 4020 adjacent to Pt. No.

NOTE: Ops 3, 4, 5 & 6 are C.M.T. controlled and no deviations are permitted.

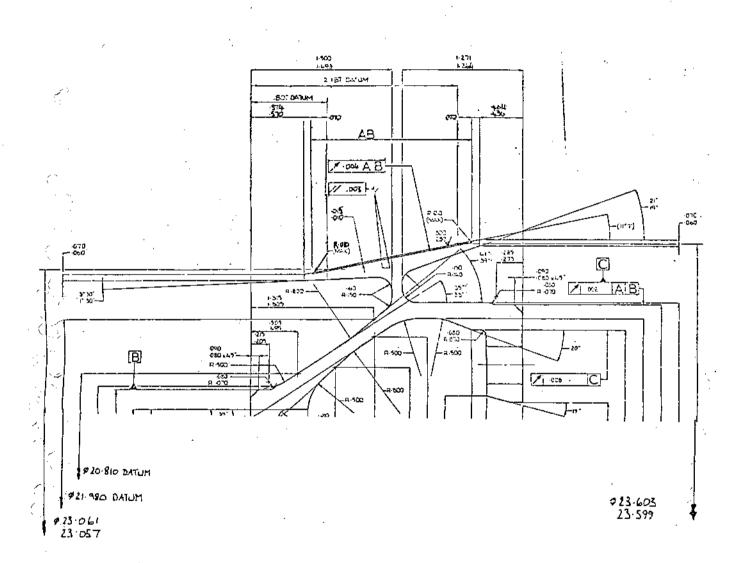
. .

The above is written in accordance with Oly/Sedp/460.

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British airways CONCORDE

TR.NO. 72-535 (cont'd)

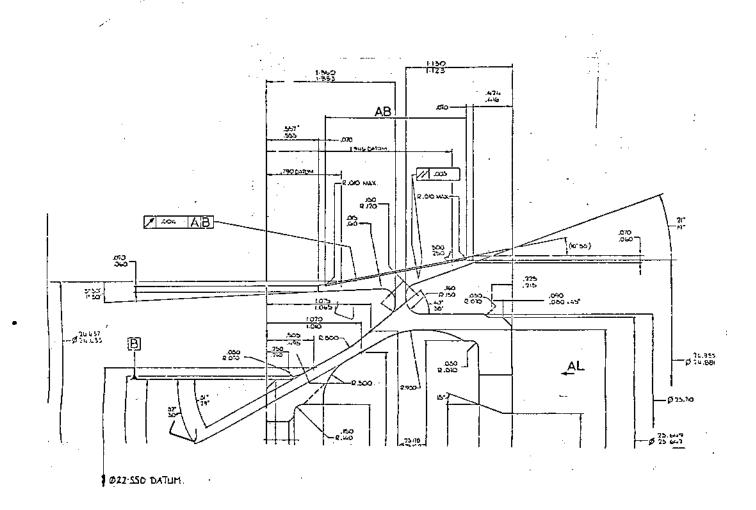


RING SPACER 3-4

TR.72-535 72-33-02 RST 4020 TR.Page 2 of 5

CONCORDE

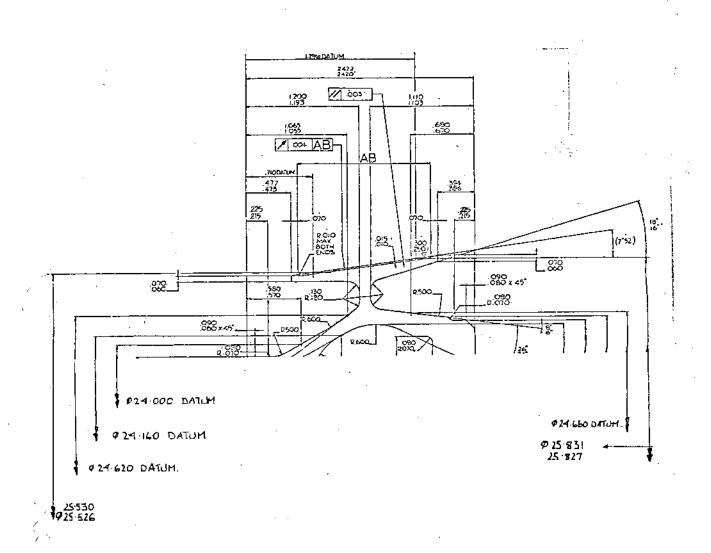
TR.NO. 72-535 (cont'd)



RING SPACER 4-5

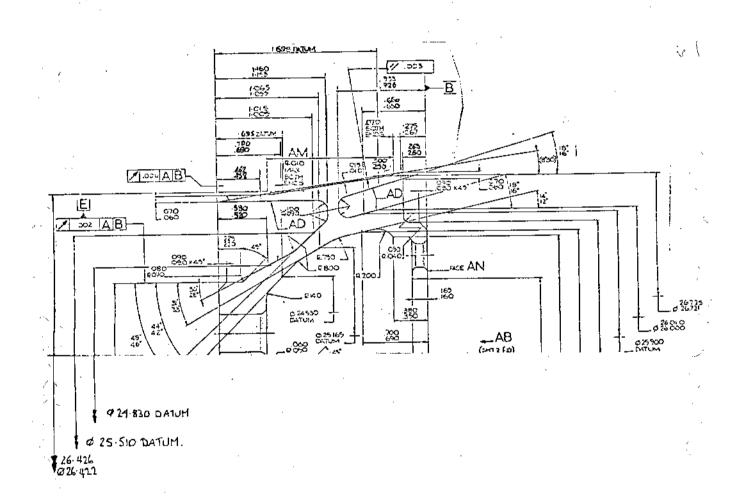
TR.72-535 72-33-20 RST 4020 TR.Page 3 of 5

TR.NO. 72-535 (cont'd)



RING SPACER 5-6

TR.NO. 72-535 (cont'd)



RING SPACER 6-7

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HP COMPRESSOR DIFFUSER CASE - REPAIR

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| 1 | Labyrinth Seal Lands Repaired by Application of Abradable Coating | SAL.B.470389-94 |
| 2 | Repair by Restoring Damping Ring Location (With Increased Interference) | SAL.B.497459 |
| 3 | Restoration of Worn Seal Housing Bores by fitting Flanged liners | SAL.B.935535-6 |
| 4 | Labyrinth Seal Land Repaired by Replacing Existing Worn Abradable Coating | SAL.B.506485 |
| 5 | Case Assy of Diffuser, Compressor HP Provision for Removal and Replacement Locally or Completely of Rokide 'Z' Coating | SAL.B.513507 |
| 6 | Diffuser Case. Repair of worn valve and inner seal bore housings by plasma spraying | SAL.B.515097 |

REPAIR 72-34-00 Contents 1 Jan 4/93

HP COMPRESSOR DIFFUSER CASE - REPAIR LABYRINTH SEAL LANDS REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Labyrinth Seal B.458602

Authority:

Modification No. OL.8360C

1. Introduction

- A. This Repair describes the procedure for restoring the labyrinth seal lands, in order to maintain the standard fin/housing clearances of labyrinth No.12. Each defective location is first built up with an abradable coating then machined to standard dimensions:
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETRES).

2. Repair Limitations

- A. Any repair scheme, or all, may be applied at one repair.
- B. Verify that there is adequate material at the defective location to permit machining to the dimensions before spraying (Ref.para.3.B.).

Summary of Operations

- A. Locate the labyrinth seal in fixture (Item 1), mount on a suitable vertical turret lathe and set true on P.C. diameter A and flange face B (Ref.Fig.401).
- B. Machine defective seal lands to the specified dimensions (Ref.Fig.402); a "witness" of grooves is acceptable.
- C. Crack test the labyrinth seal with fluorescent-penetrant.
- D. Apply Abradable Coating (Ref.Fig.403).
 - (1) Combustion spray the prepared seal lands with a bond coating of Metco 450, 0.003 in./0.005 in. (0,076 mm/0,127 mm) in thickness.

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- (2) Plasma spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating 0.030 in. (0,762 mm) in thickness over the bond coating.
- E. Refit the seal in fixture (Item 1) and set true in lathe; finish machine the seal lands (Ref.Fig. 401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Identify repair (Ref.Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the labyrinth seal.

| REPAIR SCHEME NO. | SAL B.470389 | SAL B.470390 | SAL B.470391 | SAL B.470392 | SAL B.470393 | SAL B.470394 |
|------------------------------------|------------------|---------------------|------------------|------------------|------------------|--|
| LOCATION (REF.FIG.401) | 2 | 3 | 4 | 5 | 6 | 7 |
| DIAMETER 'F' (REF.FIG. 402) | 22.370 | (557,327) 21.940 | 21.500 | 21.054 | 20.605 | 20.159 (512,039) 20.157 (511,988) |
| DIMENSION 'G' (REF.FIG. 402) | 0.080 (2,032) | 0.080 (2,032) | 0.080 (2,032) | 0.080 (2,032) | 0.080 (2,032) | 0.130 (3,302) |
| DIAMETER 'H' (REF.FIG. 403) | 22.330 | 21.900 | 21.460 | 21.014 | 20.565 | 20.122)(511,099) 20.117)(510,972) |

Before Spraying and Standard Dimensions
Table 401

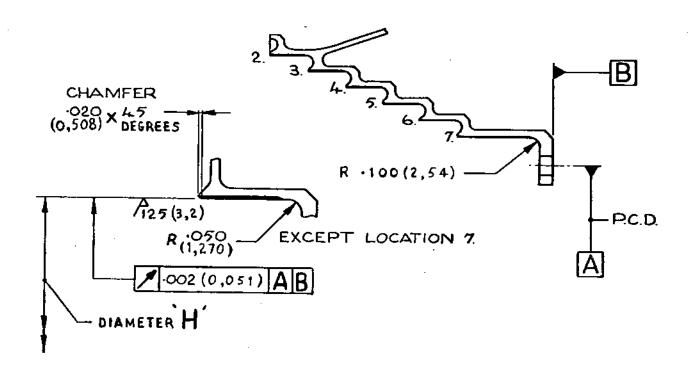
4. Special Tools, Fixtures and Equipment

| Description | Quantity | Tool No. | Item |
|-------------|----------|--------------|------|
| Fixture | 1 | s3s.12356000 | 1 |

- Replacement Parts
 - A. Not required.

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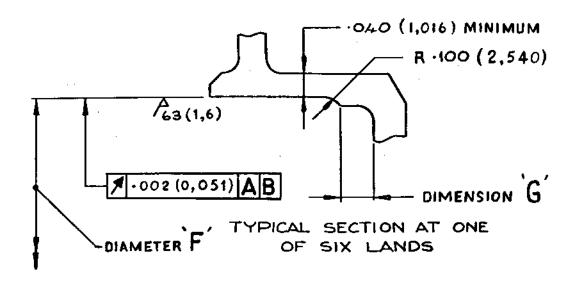


Standard Dimensions Figure 401

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Dimensions Before Spraying Figure 402

OVERSPRAY PERMITTED ON END FACE ONLY. THIS IS TO BE REMOVED. SPRAY MATERIAL MUST NOT ENCROACH WITHIN DIMENSIONS SHOWN.



Spraying Detail Figure 403

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HP COMPRESSOR DIFFUSER CASE REPAIR BY RESTORING DAMPING RING LOCATION (WITH INCREASED INTERFERENCE)

MODIFICATION NO. OL. 8727C AND OL. 8764C

1. Effectivity

| 1.P.C. | Fig/Item | <u>Part No.</u> | |
|----------|----------|-----------------|----------|
| 72-34-00 | 3 340Ä | B.925234 | B.934985 |
| | 340B | B.925782 | B.934986 |
| | 340B | B.925783 | |

2. Introduction

A. General.

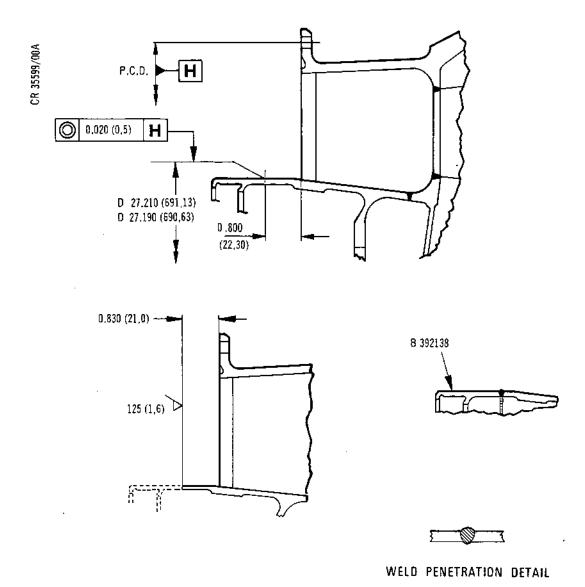
- (1) This repair describes the procedure to remove and replace the front inner ring, and fit a replacement damping ring.
- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETRES).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm), unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (6) Tolerances on angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture on machined surfaces to be 125 micro inches (3,2 micrometres), unless otherwise stated.

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3. Instructions

- A. Inspect.
 - (1) Check to ensure the rim is concentric with datum H, within the limits shown on Fig. 401.
- B. Remove Front Inner Ring.
 - (1) Locate the diffuser case in machining/welding fixture ref. tool item 1 (Ref. Fig. 402), and then locate the component/fixture assy. to a centre lathe.
 - (2) Part off the front inner ring producing the 0.830 in. (21,0 mm) dimension shown on Fig. 401.
 - (3) Remove the component/fixture assy. from the lathe and the diffuser case from the fixture.
 - (4) Remove burrs.
- C. Inspect.
 - (1) Visually inspect the diffuser case to ensure the correct parameters have been produced.
 - (2) Test the diffuser case for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-34-00, Inspection/Check.
- D. Weld Replacement Front Inner Ring to Diffuser Case.
 - (1) Withdraw from stores a replacement front inner ring B.392138 PM1.
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 - Cleaning).

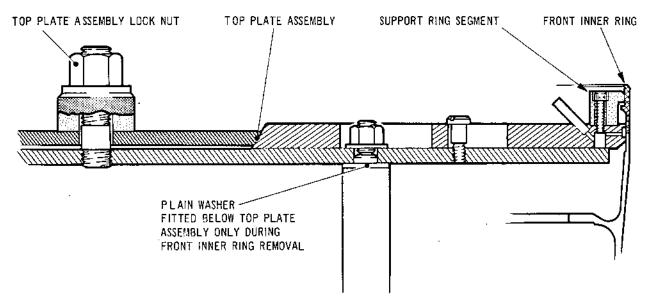




DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Removal and Welding of Front Inner Ring Figure 401

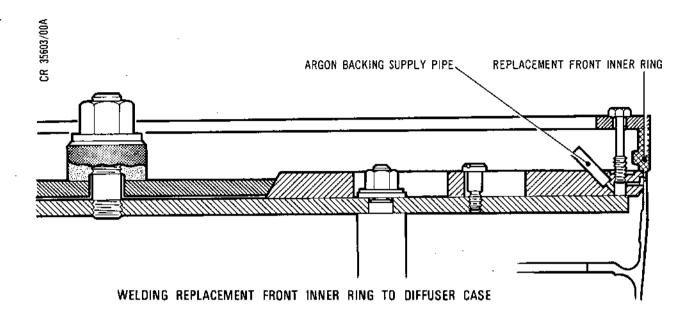
72-34-00 Repair No.2 Page 403 Feb 1/81



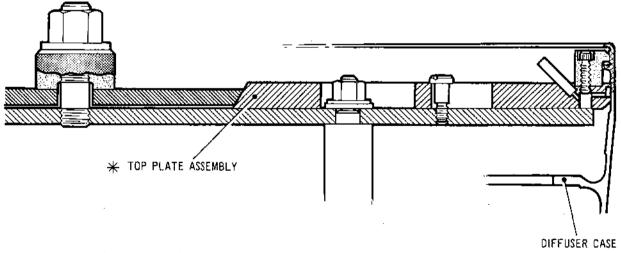
REMOVAL OF FRONT INNER RING

Turning/Welding Fixture Figure 402 (Sheet 1 of 2)

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* TOP PLATE ASSEMBLY COMPLETELY REMOVED WHEN MACHINING INSIDE DIAMETERS OF REPLACEMENT FRONT INNER RING AND ON COMPLETION OF THIS OPERATION REPLACED TO MACHINE OUTSIDE DIAMETERS



MACHINING OUTSIDE DIAMETERS WITH TOP PLATE ASSEMBLY REPLACED

Turning/Welding Fixture Figure 402 (Sheet 2 of 2)

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- (3) Using Machining/Welding fixture ref. tool item 1, assemble the replacement front inner ring to the diffuser case (Ref. Fig. 402). Form the mating ends to ensure correct alignment, using conventional forming tools. Ensure any mismatch does not exceed the limits shown in Fig. 403.
- (4) Tackweld the replacement front inner ring to the diffuser case; refer to para.6, process A, for welding data.
- (5) Remove the replacement front inner ring/diffuser case assy. from the fixture.
- (6) Check to ensure no excessive mismatch exists (Ref. para.3). If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible then the tackwelds must be broken to separate the replacement front inner ring and the diffuser case, then after dressing and cleaning the tackwelding procedure repeated.
- (7) Weld the replacement front inner ring to the diffuser case; refer to para.6, process A, for welding data.
- (8) Check that the correct amount of weld protrusion has been achieved (Ref. Fig. 401). If the weld protrusion is unsatisfactory, and cannot be corrected by a weld re-run then the two parts must be separated by machining, as detailed previously, and the whole procedure repeated.
- (9) Visually inspect the diffuser case to ensure satisfactory completion of welding.
- (10) Test the diffuser case for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-34-00, Inspection/Check.

TN 16662

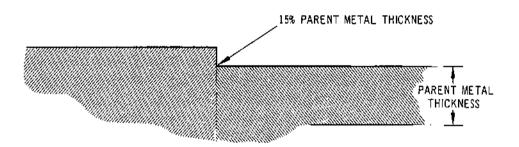
72-34-00 Repair No.2 Page 406 Feb 1/81 CR 34720/008



SUM TOTAL 'X' + 'Y'
NOT TO EXCEED 30%
OF PARENT METAL

'Y' PARENT METAL THICKNESS

DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS



STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

Acceptable Mismatch Figure 403

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(11) Carry out a non-destructive radiological (X-Ray) examination of the welded area.

E. Heat Treat.

- (1) Heat treat the diffuser case in a controlled atmosphere to 800 deg. C plus/minus 10 deg. C for 2 hours. Cool in air.
- (2) Heat treat the diffuser case in a controlled atmosphere to 700 deg. C plus/minus 10 deg.C for 16 hours. Cool in air.

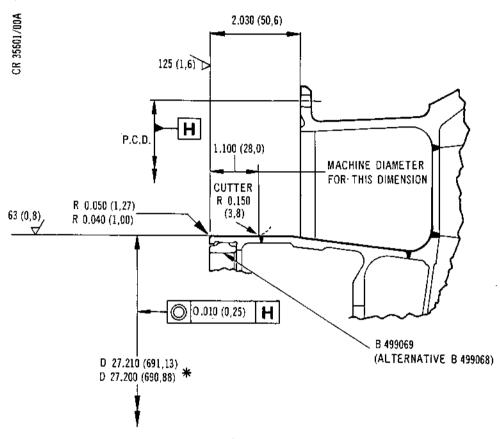
F. Finish Machine.

- (1) Locate the diffuser case in machining/welding fixture ref. tool item 1 (Ref. Fig. 402), and then locate the component/fixture assy. to a centre lathe.
- (2) Finish turn to produce the dimensions shown on Fig. 404 and 405.
- (3) Remove the component/fixture assy. from the lathe and the diffuser case from the fixture.
- (4) Remove burrs.
- (5) Visually inspect to ensure all parameters have been satisfactorily achieved.
- (6) Test the diffuser case for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-34-00, Inspection/Check.

G. Identify.

(1) Using the electro-chemical marking technique, Ref. Chapter 72-09-00, Repair, mark on SAL B.497459 or R2 close to the existing part number.





* 0.010 (0,25) STEP PERMISSIBLE ON THIS DIAMETER

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

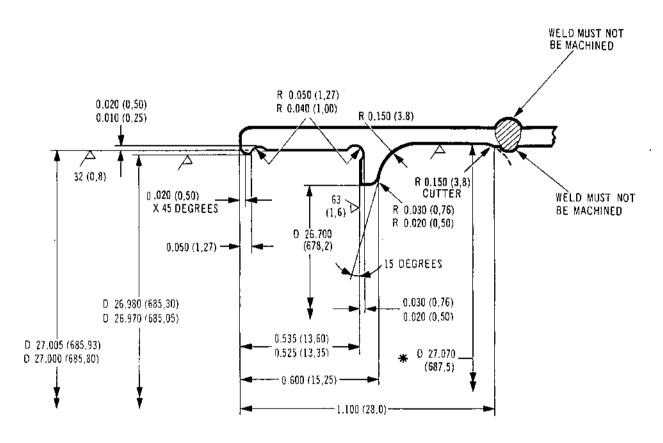
SURFACE ROUGHNESS VALUES ARE SHOWN.
THUS :- MICRO-INCHES (MICROMETRES)

Machining Details Figure 404

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CR 35602/00A

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)



* 0.010 (0.25) STEP PERMISSIBLE ON THIS DIAMETER

Machining Details and Damping Ring Assembly Figure 405

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- H. Assemble Damping Ring.
 - (1) Withdraw from stores damping ring B.499069 or B.499068.
 - (2) Install the diffuser case in a furnace and heat to 200 deg. C.
 - (3) Remove diffuser case from furnace and fit damping ring as shown in Fig. 404.
- J. Finally Inspect.
 - (1) Finally inspect the diffuser case to ensure the repair has been carried out satisfactorily and that the diffuser case is in a serviceable condition.
 - (2) Place the diffuser case in a container and store as required.
- 4. Special Tools, Fixtures and Equipment.

| Description | Quantity | Tool No. | Item | Fig.No. |
|----------------|----------|--------------|------|---------|
| Machining/Weld | ing | • | | |
| Fixture | l | S3S.15883000 | 1 | 402 |

5. Replacement Parts.

| Description | Quantity | Part No. | I.P.C. Fig./Item. |
|----------------------------------|----------|---|--------------------------------------|
| Front Inner Ring Damping Ring | 1 | B.392138 PM1 B.499069 or B.499068 | 72-34-00 3 390A 72-34-00 3 380B/C |

- 6. Welding Data.
 - A. Process A.
 - Method of welding: Automatic circumferential T.I.G. arc butt.
 - (2) Machine:
 150 amp rectifier.
 - (3) Torch: Chemetron model 425A, water cooled.
 - (4) Current:
 42 amps plus/minus 0.5 amps.

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- (5) Electrode:
 0.0625 in. (1,59 mm) dia. thoriated tungsten 2%.
- (6) Filler wire:
 Use autogenous lip without additional filler.
- (7) Argon to torch: 24 cu ft/hr (12 litres/min).
- (8) Backing:
 30 cu ft/hr (15 litres/min).
- (9) Weld speed: 3 in./min (76 mm/min).
- (10) Tackwelding:
 T.I.G. without filler rod.
 Tacks at 1.0 in. (25,4 mm) intervals.
 Diametrically opposite sequence.



HP COMPRESSOR DIFFUSER CASE RESTORATION OF WORN SEAL HOUSING BORES BY FITTING FLANGED LINERS

MODIFICATION No.0L8820C.

1. Effectivity

| IPC | <u>Fig/Item</u> | Part No. |
|----------|-----------------|-------------------------------|
| 72-34-00 | 3 340c | B934985 B934987 |
| | 340D | B934988 B934986 B934989 |

2. Introduction

A. General.

- (1) This repair describes the procedure to machine worn seal housings and to fit flanged liners.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Toterances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro inches (3,2 micrometres) unless otherwise stated.

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(8) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.

3. Instructions

A. Inspect.

- (1) Inspect and mark the seal housings to be bored.
- (2) Check the dimensions of the housings to ensure that there will be a minimum wall thickness of 0.100 in. (2,54 mm) after machining (Ref.Fig.402).

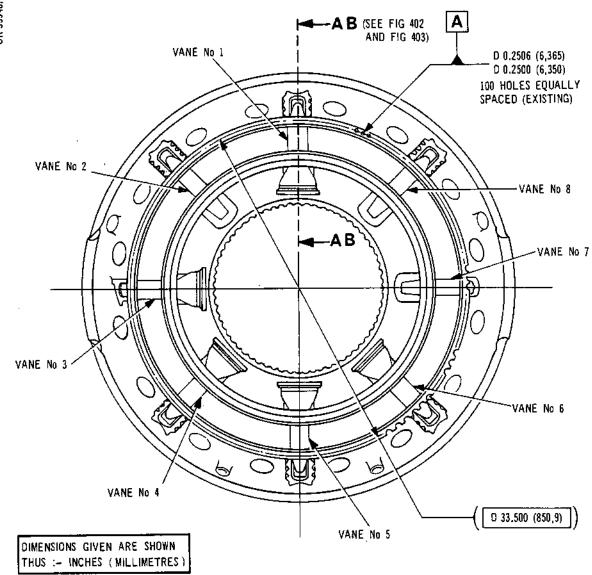
B. Machine.

- (1) Locate the diffuser case assembly to a round table on a jig boring machine fitted with a right angle head.
- (2) Set true to within 0.004 in (0,10 mm) parallel of face B, and within 0.004 in (0,10 mm) square of hole A. (Ref.Figs.401,402).
- (3) Finish bore to the dimensions shown in Figures 402 and 403.
- (4) Remove burrs and sharp edges.

C. Inspect.

- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in Chapter 72-34-00 Inspection/Check.

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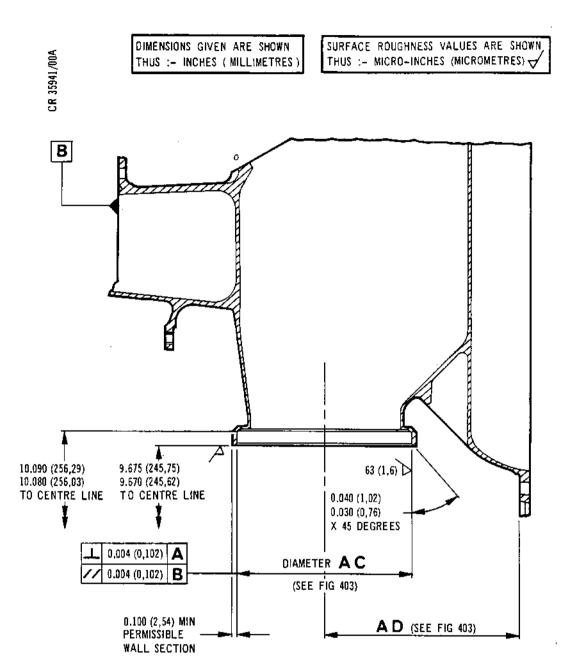
VIEW ON CASE LOOKING REARWARD

Delivery Casing Assembly Figure 401

REPAIR

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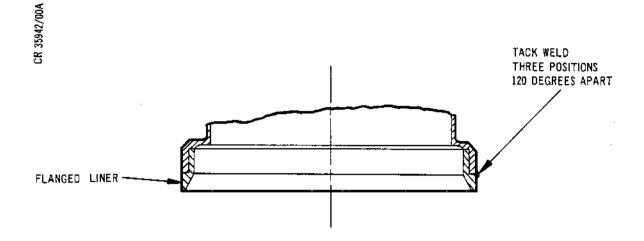




SECTION A B - A B VANE 1 VANES 3, 4, 5 AND 6 SIMILAR (SEE FIG 401)

Seal Housing Machining Details Figure 402

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PART SECTION AB-AB (SEE FIG 401)

| LOCATION | 01A A C | DIM A D | LINER FLANGED PART No | SCHEME No |
|------------------|--------------------------------------|----------------------------------|--------------------------|-----------|
| VANES 1 AND 4 | 4,4109 (112,037) 4,4100 (112,014) | 5,000 (127,00) 4,990 (126,75) | B 935537 | В 935535 |
| VANES 3, 5 AND 6 | 4.1609 (105,687) 4.1600 (105,664) | 4,850 (123,19) 4,840 (122,94) | B 935538 | B 935536 |

DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Seal Housing Liners Figure 403

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- D. Assemble flanged liners.
 - (1) Withdraw from stores flanged liners B935537 and B935538 as required (Ref_Fig_403).
 - (2) Place the diffuser case in an oven, and heat to approximately 200 deg.C.
 - (3) Freeze the liners in liquid nitrogen in order to shrink-fit them into the diffuser case.
 - (4) Remove the diffuser case from the oven and the liners from the liquid nitrogen, and immediately assemble the liners to the case.
 - (5) Allow the temperatures of the case and liners to return to room temperature.

E. Inspect.

(1) Inspect for the satisfactory completion of the assembly of the liners.

F. Tackweld.

(1) Tackweld each liner to the diffuser case in three positions 120 deg. apart as shown in Figure 403, using manual argon arc welding with filler MSRR9500/200.

G. Inspect.

- (1) Inspect for the satisfactory completion of the tackwelding operation.
- (2) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in Chapter 72-34-00 Inspection/Check.

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- H. Identify.
 - (1) Mark SAL.8935535-6 or R3 adjacent to the existing part number, using electro-chemical marking or vibropercussion engraving as specified in Chapter 72-09-00 Repair.
- J. Final Inspection.
 - (1) Finally inspect the diffuser case assembly to ensure that the repair has been carried out satisfactory, and that the case assembly is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

| <u>Description</u> | <u>Qty</u> | <u>Part No.</u> | <pre>IPC Fig./Item</pre> |
|--------------------|------------|-----------------|--------------------------|
| Liner, flanged | 2 (max) | в935537 | 72-34-00 |
| Liner, flanged | 3 (max) | B935538 | 72-34-00 |



HP COMPRESSOR DIFFUSER CASE - REPAIR LABYRINTH SEAL LANDS REPAIRED BY APPLICATION OF ABRADABLE COATING

MODIFICATION NO. OL.8887C

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u> 72-34-00 2 110 B931882

2. Introduction

A. General.

- (1) This repair describes the procedure for removing worn coatings, applying new coatings and machining to size.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0.51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0.25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.



B. Repair Limitations.

(1) Ensure that there is sufficient material at the defective location to permit machining to the dimensions before coating. A witness of grooves is acceptable.

3. <u>Instructions</u>

A. Machine.

- (1) Locate fixture ref. tool item 1 to a vertical lathe.
- (2) Locate the Labyrinth seal to the fixture and set true to datum face A and datum diameter B (Ref. Fig. 401).
- (3) Machine the lands at all stations to remove the existing coating (Ref. Figs. 401 and 402). The bond coat may be removed by nitric acid cleaning using a 50% solution as instructed in TSD 594 OP122.

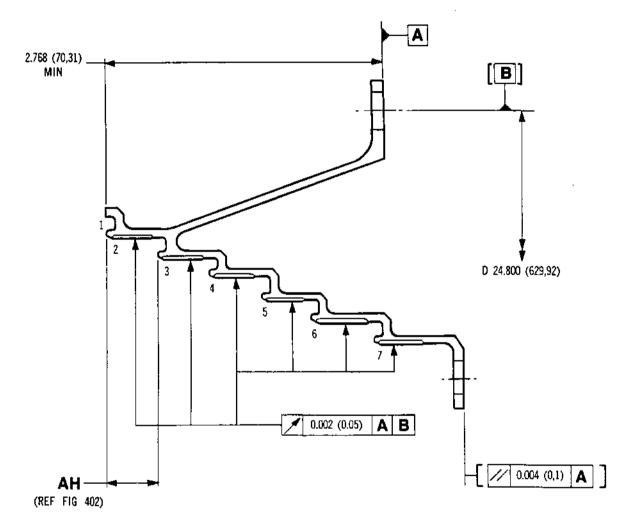
B. Inspect.

- (1) Inspect for the satisfactory completion of the previous operations.
- (2) Crack test the Labyrinth using the dye penetrant process specified for this component in Chapter 72-34-00 Inspection/Check.

C. Apply Abradable Coating.

- (1) Combustion spray the prepared seal lands with a bond coat of Metco 405 NS 0.005/0.003 in. (0,13/0,08 mm) in thickness, as instructed in TSD 594 0P704.
- (2) Plasma spray Metco 301 NS abradable coating 0.030 in. (0,76 mm) in thickness over the bond coat, as instructed in TSD 594 OP704.

CR 36118/00A



STATION No 1 NOT REPAIRABLE BY THIS SCHEME

DIMENSIONS GIVEN ARE SHOWN THUS:--INCHES (MILLIMETRES)

Labyrinth Seal Details Figure 401

REPAIR 72-34-00 Repair No.4 Page 403 Dec 1487



OVERSPRAY PERMITTED ON
END FACES BUT IS TO BE
REMOVED. OVERSPRAY NOT
PERMITTED BEYOND SPRAY
AREA

PERMITTED BEYOND SPRAY
AREA

WITNESS OF EXISTING
GROOVES ACCEPTABLE
WHEN REPAIRING REWORKED
PRE SB.72-8574-278

[0.020 (0.51) x 45 DEGREES)

MAX

(30 DEGREES)

0.020 (0.51) MIN

D AD

D AG

TYPICAL SECTION THROUGH SEALS (REF FIG 401)

OIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

| STATION | DIA AD | DIA AE | DIM AF MIN | DIA AG | DIM AH MAX |
|---------|------------------------------------|------------------------------------|--------------|------------------------------------|---------------|
| 2 | 22.372 (568,25) 22.370 (568,20) | 22.317 (566,85) 22.312 (566,72) | 0.040 (1,02) | 22.335 (567,31) 22.330 (567,18) | |
| 3 | 21.942 (557,33) 21.940 (557,28) | 21.887 (555,93) 21.882 (555,80) | 0.040 (1,02) | 21.905 (556,39) 21.900 (556,26) | 0.510 (12,95) |
| 4 | 21.502 (546,15) 21.500 (546,10) | 21.447 (544,75) 21.442 (544,63) | 0.040 (1,02) | 21.465 (545,21) 21.460 (545,08) | 1.020 (25,91) |
| 5 | 21.056 (534,82) 21.054 (534,77) | 21.001 (533,43) 20.996 (533,30) | 0.040 (1,02) | 21.019 (533,88) 21.014 (533,76) | 1.530 (38,86) |
| 6 | 20.607 (523,42) 20.605 (523,37) | 20.552 (522,02) 20.547 (521,89) | 0.040 (1,02) | 20.570 (522,48) 20.565 (522,35) | 2.040 (51,82) |
| 7 | 20.159 (512,04) 20.157 (511,99) | 20.104 (510,64) 20.099 (510,51) | 0.250 (6,35) | 20.122 (511,10) 20.117 (510,97) | |

Labyrinth Seal Dimensions Figure 402

> 72-34-00 Repair No.4 Page 404 Dec 1/87



- D. Machine.
 - (1) Locate fixture ref. tool item 1 to a vertical lathe.
 - (2) Locate the labyrinth seal to the fixture and set true to datum face A and datum diameter B (Ref. Fig. 401).
 - (3) Finish machine the seal lands to the dimensions given in Figures 401 and 402.
- E. Inspect.
 - (1) Inspect the seal lands visually for the integrity of the coating and continuity of the sprayed edges.
- F. Identify.
 - (1) Mark SAL.B.506485 or R4 adjacent to the existing part number, using electro-chemical marking or vibro-percussion engraving as specified in Chapter 72-09-00 Repair.
- G. Final Inspection.
 - (1) Finally inspect the labyrinth seal to ensure that the repair has been carried out satisfactorily and that the labyrinth seal is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Qty</u> | Tool No. | <u>Item</u> |
|--------------------|------------|---------------|-------------|
| Fixture | 1 | \$3\$12356000 | 1 |

Replacement Parts

None.



CASE, ASSY OF. DIFFUSER, COMPRESSOR H.P.

PROVISION FOR THE LOCAL OR COMPLETE REMOVAL AND REPLACEMENT OF THERMAL BARRIER COATING.

B513507

1. EFFECTIVITY

| IPC | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|-----------------|
| 72-34-00 | 03 340A | B925231 |
| | 03 340B | В925783 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

PART A: Repair by reapplying Thermal barrier coating locally (for damage not exceeding 20% of area covered).

PART B: Repair by removing and re-applying complete Thermal barrier coating (for damage exceeding 20% of area covered).

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Inspect and determine extent of Thermal barrier damage. Proceed to Part A or B in accordance with Repair Limitations.

> 72-34-00 Repair No. 5 Page 401 Jan 31/95

REPAIR

PART A: REPAIR BY APPLYING THERMAL BARRIER COATING LOCALLY.

- Mask area(s) surrounding damaged Thermal barrier coating. Protect all holes and passages, preferably by means of plugs.
- 2) Abrasive Blast damaged area(s) of coating within area(s) AC as required.

Refer TSD 594 OP.704. Refer fig's 401 to 403.

3) Apply bond coat to a thickness of 0.003/0.005 (0,08/0,13) on prepared surface(s).

Apply top coat to a thickness of 0.015/0.020 (0,38/0,51), ensuring a 0.020/0.025 (0,51/0.64) overlap with existing coating.

All holes (plain and tapped) to have an area 0.100 (2,54) larger in diameter free from coating.

Refer TSD 594 OP.704.
Refer fig's 401 to 403.
Use MSRR 9507/109 bond coat and MSRR 9507/108 top coat.
Alternatively;
Use Omat 3/135 bond coat and OMat 3/160 top coat.

4) Visually inspect coating for evidence of blistering, lifting, cracking or chipping. If coating is defective, work to Part B of this Repair Instruction. Refer TSD 594 OP.704

- 5) Dress coating to blend smoothly into existing contour.
- 6) Mark Repair Instruction number RI B513507A or R5A on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

PART B: REPAIR BY REMOVING AND RE-APPLYING COMPLETE THERMAL BARRIER COATING.

 Mask areas not Thermal barrier Refer 1 coated.
 Protect all holes and passages, preferably by means of plugs.

Refer fig's 401 to 403.

REPAIR

72-34-00Repair No. 5

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1K.610-14-28 snecma OVERHAUL

 Abrasive Blast areas AC as required to completely remove Thermal barrier coating. Refer fig's 401 to 403. Refer Overhaul Manual Chapter 72-09-25 Repair using Process K.

- 3) Inspect repair area for complete removal of Thermal barrier coating.
- 4) Mask area(s) not requiring
 Thermal barrier coating.
 Protect all holes and passages,
 preferably by means of plugs.

Refer fig's 401 to 403

5) Abrasive Blast area(s) to be coated.

Refer TSD 594 OP.704. Refer fig's 401 to 403.

6) Apply bond coat to a thickness of 0.003/0.005 (0,08/0,13) on prepared surface(s). Apply top coat to a thickness of 0.015/0.020 (0,38/0,51). All holes (plain and tapped) to have an area 0.100 (2,54) larger in diameter free from coating.

Refer TSD 594 OP.704.
Refer fig's 401 to 403.
Use MSRR 9507/109 bond coat and MSRR 9507/108 top coat.
Alternatively;
Use Omat 3/135 bond coat and OMat 3/160 top coat.

7) Visually inspect coating for evidence of blistering, lifting, cracking or chipping. Refer TSD 594 OP.704

8) Mark Repair Instruction number RI B513507B or R5B on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique. Refer Overhaul Manual Chapter 72-09-00 Repair.

MATERIAL

COMPONENT

<u>MATERIAL</u>

RR CODE

CASE, ASSY OF. DIFFUSER COMPRESSOR H.P.

NIMONIC PE11 MSRR 7181 QHH

6. DATA

NONE.

REPAIR 72-34-00 Repair No. 5 Page 403 Jan 31/95



7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

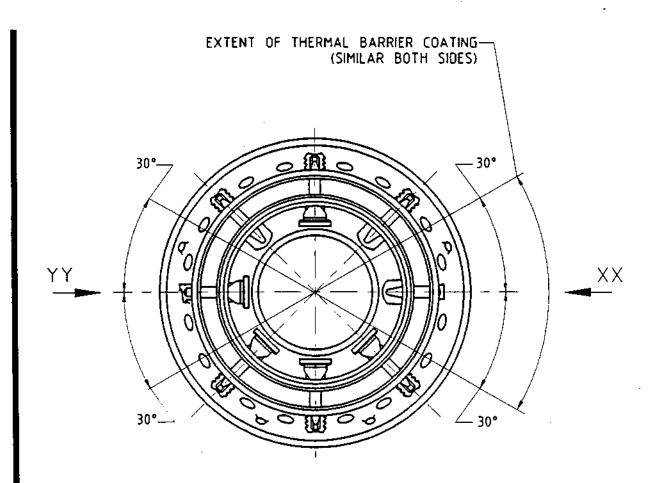
DESCRIPTION

QUANTITY

ITEM

NONE.

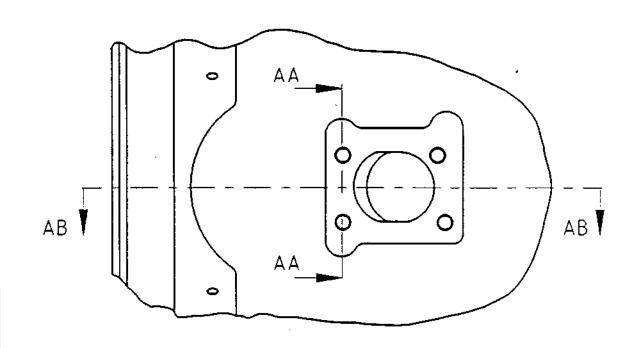
REPAIR 72-34-00 Repair No. 5 Page 404 Jan 31/95

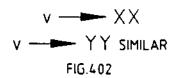


DIAGRAMMATIC VIEW ON FRONT OF CASING FIG.401

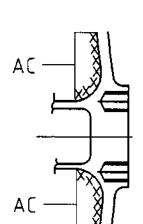
REPAIR 72-34-00 Repair No. 5 Page 405 Jan 31/95

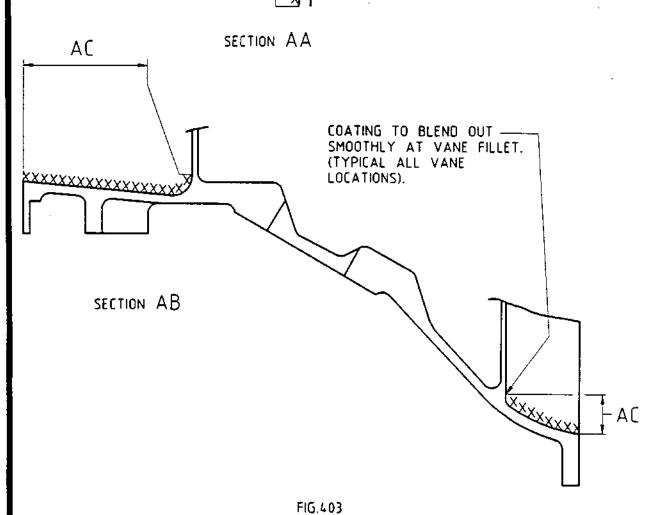






REPAIR 72-34-00 Repair No. 5 Page 406 Jan 31/95





REPAIR 72-34-00 Repair No. 5 Page 407 Jan 31/95



CASE, ASSEMBLY OF, DIFFUSER, COMPRESSOR HP

REPAIR OF WORN VANE END INNER SEAL BORE HOUSINGS BY PLASMA SPRAYING

REPAIR NO. B515097

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | Part No. |
|------------|------------------|-------------------------------|
| 72-34-00 | 3 340A | B925234 B925232 |
| | 340B | 8925231 8925783 8925782 |
| | 340c | B934985 B934987 |
| | 340D | B934988 B934986 B934989 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be embodied any number of times provided stated limits are not exceeded. Any number of vane end inner seal bore housings may be repaired.

Seal bore housings previously repaired to B935535-6 (R3) are not applicable to this Repair Instruction.

Temporary re-protection of components between operations should be carried out in accordance with TSD 594 OP.340.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

72-34-00 Repair No. 6 Page 401

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4. REPAIR PROCEDURE

REPAIR PROCEDURE

 Visually inspect for previous embodiment of this Repair Instruction.

NOTE: Operations 2 to 5 are applicable to first repair arisings only. For repeat repairs proceed directly to operation 6.

- 2) Locate component to machine and set true to datums. Use existing unworn areas of seal housing bore to minimise positional error.
- 3) Machine bore to pre-spray dimensions.
- -4) Machine outer diameter of seal housing (Diameter AB) to establish Repair datum D.
 - Dimensionally inspect repair area.
 - 6) Locate component to machine and set true to datums A, B and D.
 - 7) Machine to completely remove existing coating from seal bore. Remove minimum parent material.
 - Locally etch machined seal bore to ensure coating has been completely removed.
 - Dimensionally inspect repair area. Record actual bore diameter for future reference.
 - 10) Locally crack detect machined area(s).

11) Plasma spray bond coat to machined location 0.003/0.005 (0,08/0,13) thick.

SUPPLEMENTARY INFORMATION

Refer fig. 402 for identity location.

Refer figs. 401 and 402.

Refer fig. 403.

Refer fig.403.

Refer fig. 403.

Refer figs. 401 to 403.

Refer fig.403.

Refer Overhaul Manual Chapter 72-09-14 Repair Solution B.

Refer Overhaul Manual Chapter 72-34-00 Inspection/Check.

Refer to TSD 594 OP.704 using OMat 3/188. Refer fig.403 and 404.

-34-00

REPAIR

Repair No. 6 Page 402 Jan 4/93 NOTE: For repeat repairs a thicker bond coat may be required. Using bore dimension established at operation 9), calculate the necessary bond coat thickness to achieve a finished machined top coat thickness of 0.005/0.010 (0,13/0,25).

12) Plasma spray top coat applying sufficient coating to clean up on finish machining. Refer to TSD 594 OP.704 using OMat 3/81 or OMat 3/80. Refer fig.404.

13) Locate component to machine and set true to datums.

Refer figs.401, 402 and 405.

14) Finish machine. Coated areas to be diamond ground. Overspray to be removed. Refer TSD 594 OP.704. Refer fig.405.

15) Remove from machine, de-burr and break sharp edges.

16) Dimensionally inspect.

17) Crack detect.

Refer fig.405.

Refer Overhaul Manual Chapter 72-34-00 Inspection/Check.

18) Mark Repair Instruction number RI B515097 or R6 and applicable coating identity symbols adjacent to the normal 'assy.of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer fig.402 for identity marking location. Nb. Symbol HA is OMat 3/188 CO is OMat 3/81

CN is OMat 3/80

HA

and



4

NOTE: Where the Facility decision has been to Repair less than all five seal housing bores then mark those housing(s) repaired, on diameter AB, using the symbol indicated below.

Refer fig. 403.

 \overline{R}



5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u> <u>RR CODE</u>

CASE, ASSEMBLY OF, NIMONIC ALLOY
DIFFUSER, COMPRESSOR HP BSEM 660

6. DATA

NONE.

7. TOOLS

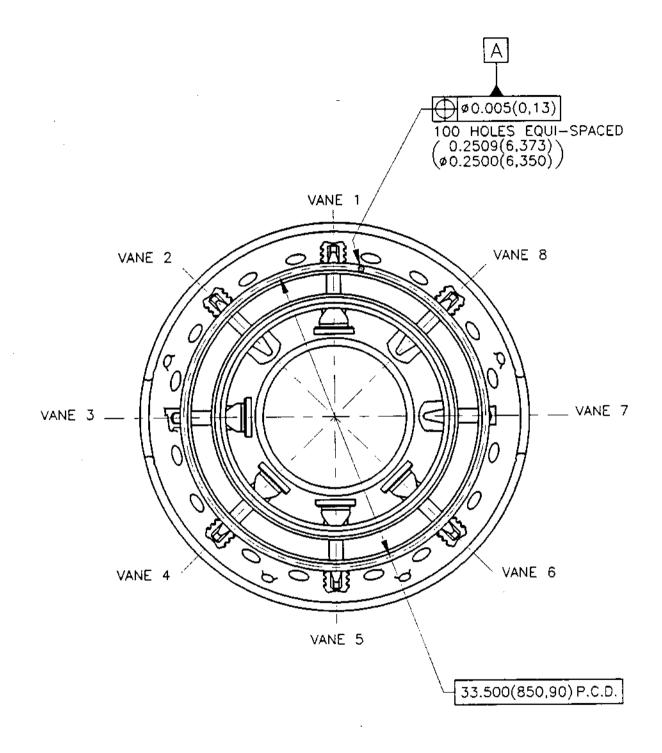
TOOL NUMBER DESCRIPTION ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

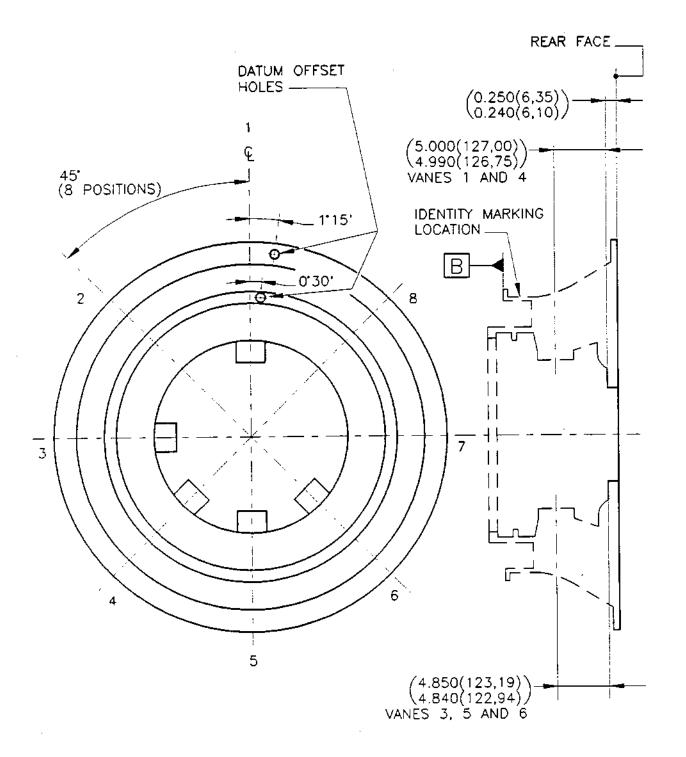
NONE.



VIEW ON FRONT OF CASING LOOKING REARWARD FIG.401

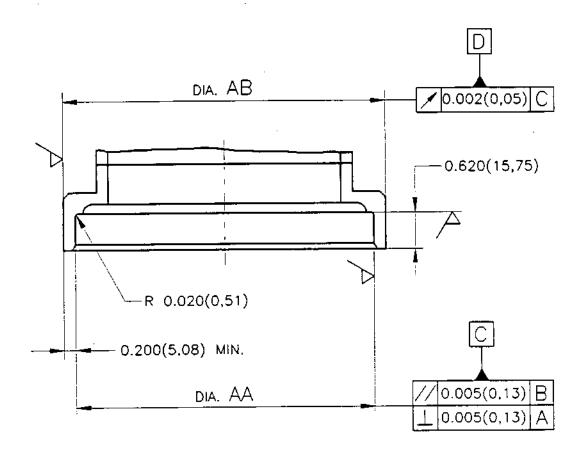
REPAIR 72-34-00 Repair No. 6 Page 405 Jan 4/93





DIAGRAMMATIC VIEW SHOWING POSITION OF VANES LOOKING REARWARD FIG.402

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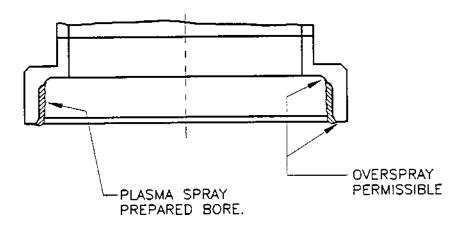


TYPICAL SECTION THROUGH VANES 1, 3, 4, 5 AND 6 SHOWING PRE-SPRAY MACHINING DETAILS

| LOCATION | DIAMETER AA | | DIAMETER AB |
|----------|----------------|----------------|----------------|
| LOCATION | FIRST REPAIR | REPEAT REPAIRS | |
| VANES 1 | 4.272(108,51) | Ø4.285(108,84) | ø4.700(119,38) |
| AND 4 | ø4.270(108,46) | (MAXIMUM) | |
| VANES 3, | 4.022(102.16) | ø4.035(102.49) | ø4.450(113,03) |
| 5 AND 6 | ø4.020(102,11) | (MAXIMUM) | |

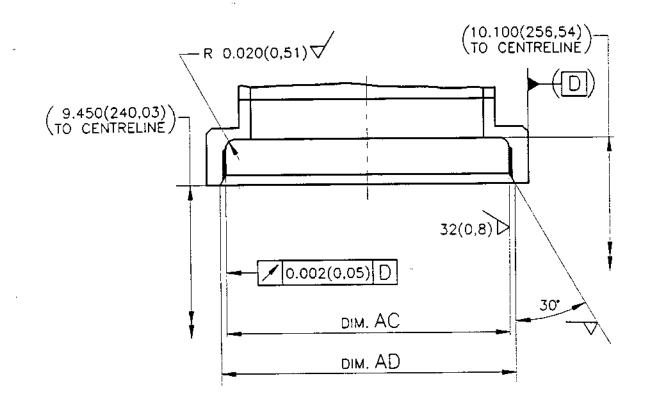
FIG.403





TYPICAL SECTION THROUGH SEAL BORES IN VANES 1, 3, 4, 5 AND 6 SHOWING SPRAY REQUIREMENTS. FIG.404

REPAIR 72-34-00 Repair No. 6 Page 408 Jan 4/93



TYPICAL SECTION THROUGH 1, 3, 4, 5 AND 6 SHOWING FINAL MACHINING DETAILS

| LOCATION | VANES 1 AND 4 | VANES 3, 5 AND 6 |
|----------|---------------------------------|---------------------------------|
| дім. АС | 4.252(108,00) ø4.250(107,95) | 4.002(101,65) ø4.000(101,60) |
| дім. AD | ø4.500(114,30) | ø4.250(107,95) |

FIG.405

REPAIR 72-34-00 Repair No. 6 Page 409 Jan 4/93

British airways

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-527
Insert in 72-34-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

To introduce a repair scheme for replacing union end with thread pick-up on tube assembly - insulated turbine drains P/No's. B451679 and B488979. (MRA 139).

ACTION

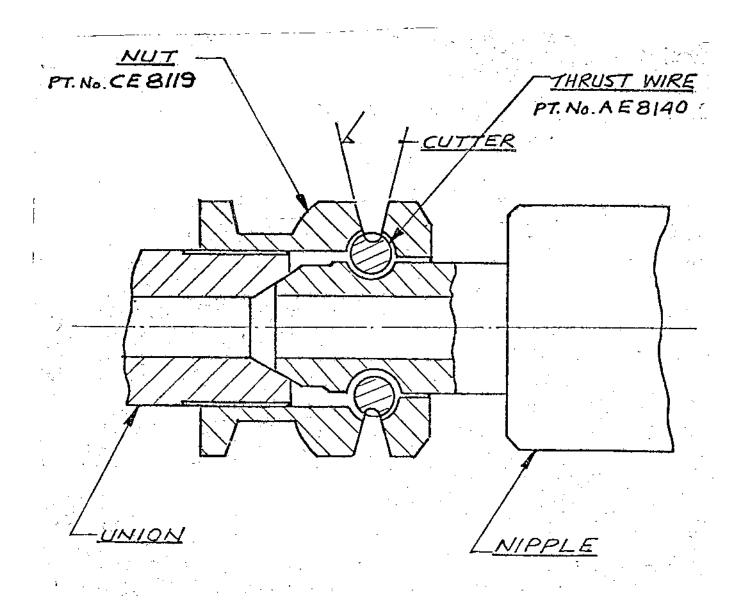
BEOL REPAIR: RST 4004. Tube Assembly - Cutting damaged union end - replacing with new nut and thrust wire.

PROCEDURE

- 1. Assemble male union of comparable thread size to lock nut in a suitable condition for repair.
- 2. Using suitable cutter cut through nut into thrust wire as shown.
- 3. Discard both sections of nut and withdraw and discard thrust wire.
- 4. Inspect nipple end.
- 5. Assemble replacement nut and retain in position with new thrust wire.
- 6. Vibro engrave RST 4004 adjacent to part number.
- 7. Final Inspect.
- 8. This RST is in accordance with OLY/SEDP/543.

British airways

TEMPORARY REVISION No. 72-527



British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-531 Insert in 72-34-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

To introduce a repair scheme for worn vane end inner seal bore housings on H.P. Diffuser case (MRA 99)

ACTION

B.E.O.L. REPAIR

RST 4015 H.P. DIFFUSER CASE - WORN VANE END INNER SEAL BORE HOUSINGS.

PROCEDURE: -

1. Suitably secure on machine and bore repair area to fig. A dimensions, in preparation for Plasma spray.

Ref. Vane 1 & 4 = 4.272/4.270 Dia. Vane 3, 5 & 6 = 4.022/4.020 Dia.

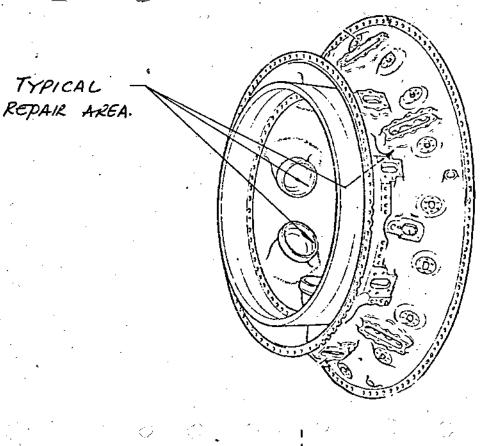
- Apply bond coat 0.003/0.005 thick, using Metco 450 (MSRR 9507/5) as per T.S.D. 594 op. 704. Ref. Fig. B.
- 3. Apply final coat of Plasma spray, using X40, to sufficient thickness for final machining, as per T.S.D. 594 Op. 704.
- 4. Check for cracking/adhesion as per T.S.D. 594 Op. 704.
- 5. Final machine repair area as per Fig. C.

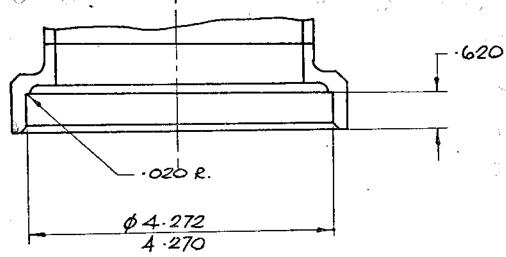
Ref. Vane 1 & 4 = 4.252/4.250 Dia. Vane 3, 5 & 6 = 4.002/4.000 Dia.

- 6. Visually Inspect.
- 7. Vibro engrave RST4015 adjacent to Pt. No.
- 8. This RST is written I.A.W. Oly/Sedp/963

British airways CONCORDE

TR.No. 72-531 (cont'd)





VANES 1 \$ 4.

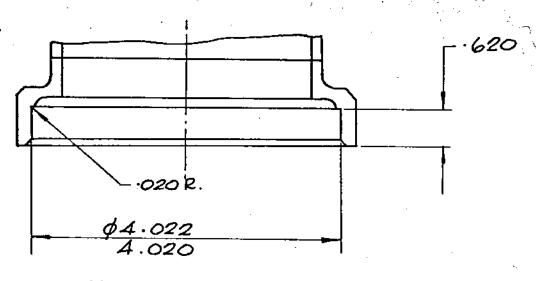
FIG. A.

TR.72-531 72-34-00 RST 4015 TR.Page 2 of 4

1 May 1981

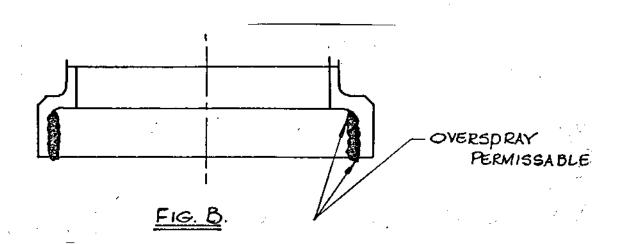
British airways CONCORDE

TR.No. 72-531 (cont'd)



VANES 3,546.

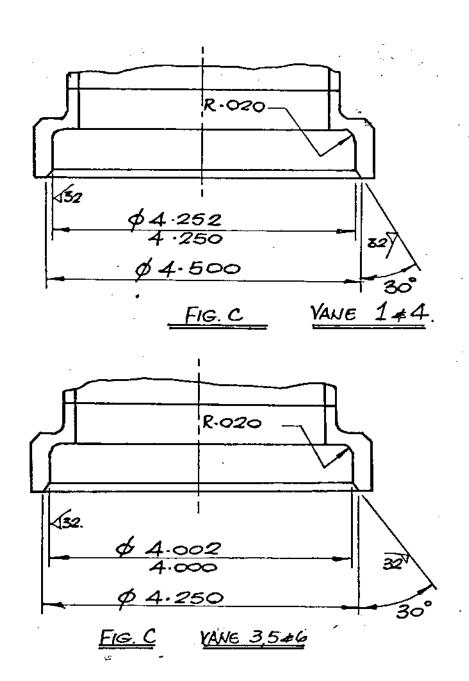
FIG. A.



TR.72-531 72-34-00 RST 4015 TR.Page 3 of 4

British airways CONCORDE

TR.NO. 72-531 (cont'd)



TR.72-531 72-34-00 RST 4015 TR.Page 4 of 4

British airways

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-547

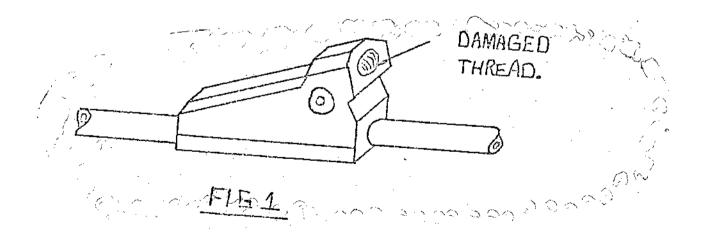
Insert in 72-34-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

Repair to Air venting tube assembly - internal thread damage by tapping O/S and fitting a wire thread insert (MRA 127).

ACTION

- 2. Fit wire thread insert as 6733/4.
 Insert to 1 to 1½ turns below surface.
- 3. Vibro engrave 'RST 4030' adjacent to Part Number.
- 4. Finally Inspect.
- 5. The above is written in accordance with Oly/Sedp/837





COMBUSTION CHAMBER - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme | No. |
|---------|------------|--|--------|-----|
| England | 1 | CANCELLED (See Table of Approved Repair Schemes) | | |
| Ë | 2 | CANCELLED (See Table of Approved Repair Schemes) | | |
| Printed | 3 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 4-1 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 4-5 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 4-15 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 4-18 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 4-36 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 4-38 | CANCELLED (See Table of Approved Repair Schemes) | | |
| | 5 | CANCELLED (See Table of Approved Repair Schemes) | | · |
| | 6 | CANCELLED (See Table of Approved Repair Schemes) | | |

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| Rep | air No. | Title | Scheme No. |
|-----|---------|---|--------------------------------|
| | 7 | Replacement of head assembly | SAL 8.497552 |
| l | 8 | Chamber, Assembly, Combustion. Replacement of vaporizers | SAL 8.517613 |
| | 9 | Replacement of No.3 inner cooling ring and adjacent inner front chamber section | SAL B.497578 SAL B.497579 |
| 1 | 0 | Replacement of No.3 outer cooling ring and adjacent outer front chamber section | SAL B.497554 SAL B.497555 |
| 1 | 1 | Replacement of damaged sections | SAL B.497550-89 B.935550-82 |
| 1 | 2 | CANCELLED (See Table of Approved Repair Schemes) | |
| 1 | 3 | CANCELLED (See Table of Approved Repair Schemes) | |
| 1 | 4 | Replacement of thermal barrier coating | SAL B.935546 |
| 1 | 5 | Repair of damaged sections by patching | SAL 8.935544 |
| 1 | 6 | Repair of cracks by welding and blending of light impact damage | SAL B.935545 |
| 1 | 7 | Head assembly repaired by welding cracks and patching | SAL B.499432 |
| 1 | 8 | Restoration of used vaporiser retaining nuts | SAL B.935592 |
| 1 | 9 | Sermaloy J coating on head assembly | SAL.B.935591 |
| Z | 10 | Replacement of complete inner and/or outer chamber assemblies | SAL.B.507640-2 |

REPAIR
72-41-01
Contents 2
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| Repair No. | Title | Scheme No. |
|------------|--|--------------------------|
| 21 | Vaporiser locations restored by fitting oversize pins | SAL.B.507923 B.507929 |
| 22 | Removal of cracks in vaporisers by blending | SAL.B.506045 |
| 23 | Chamber, Assembly Combustion. Repair of cracking/burning in the No.7 inner cooling ring and adjacent forward section by direct/puddle welding | SAL B.514672 |
| 24 | Not Used | |
| 25 | Chamber, Assembly, Combustion. Replacement of head, sub-assy of using engine run or new inner and/or outer barrels (Post Mod.8981) | SAL.B.516207 |
| 26 | Chamber, Assembly, Combustion. Replacement of head sub assy. of using engine run or new inner and/or outer barrels | SAL.B.517529-30 |
| 27 | Chamber, Assembly, Combustion. Replacement of damaged sections | SAL.B.517456-93 |
| 28 | Chamber, Assembly, Combustion. Restoration of the outer Barrel H.P. N.G.V. location face by reactive diffusion brazing. | SAL.B.517775 |
| 29 | Chamber, Assembly, Combustion (Post Mod. 72-9086). Complete Replacement of Thermal Barrier Coatings. | SAL.B.518353 |
| | _ | DED |

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COMBUSTION CHAMBER (2BR) - REPAIR REPLACEMENT OF HEAD ASSEMBLY

MODIFICATION NO. OL.8744C, OL.8851C

1. Effectivity

| <u>I.P.C.</u> | <u>Fig</u> | ./Item | | Part No. | |
|---------------|------------|--------|--|--|--|
| | 2 | 10 | B.934945, B.936627, B.936863, B.936869, B.936880, B.936885, B.938014, B.938017, B.938173, B.938183, B.938183, B.938506, | B.934943, B.935462, B.936630, B.936865, B.936871, B.936876, B.936938, B.936938, B.938015, B.938018, B.938021, B.938178, B.938178, B.938501, | B.935463, B.936862, B.936867, B.936873, B.936884, B.938013, B.938016, B.938019, B.938022, B.938179, B.938182, B.938505, |
| | | | 0.730307, | в.938510. | |

Introduction

A. General

- (1) This repair describes the procedure for replacing the combustion chamber head assembly to restore the chamber to a serviceable condition.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.

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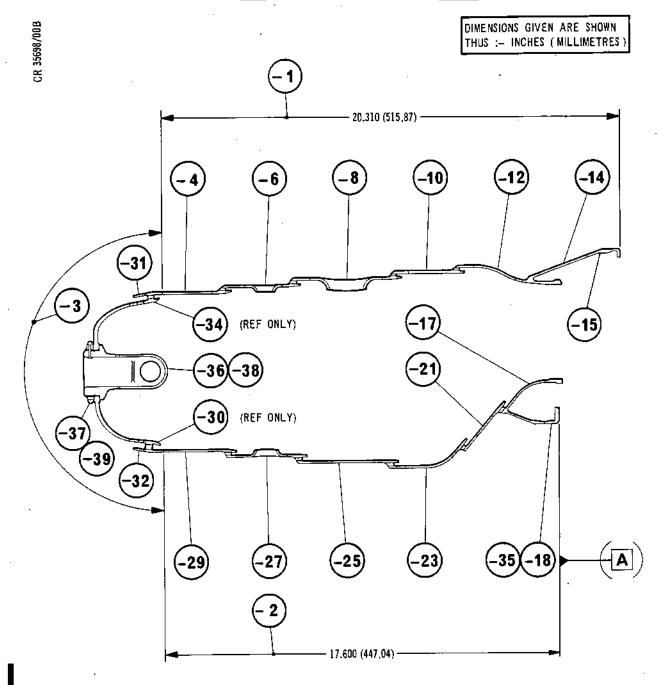


- (7) Surface texture is to be 125 micro inches (3,2 micrometers) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) After welding, ovality and shrinkage on items indicated Z (Ref.Fig.417) may be up to minus 0.240 in. (6,096 mm) on diameter.
- (10) The igniter hole positions (Ref.dash item 4, Fig.401) may be plus/minus 0.050 in. (1,27 mm) from the horizontal centre line of the combustion chamber after welding.
- (11) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.
- (12) All welds are classified as Group 2.
- B. Repair Limitations.
 - (1) Salvages identified in Table 401 may be used in any combination with Salvages in the range B497550-89.

NOTE: Combustion chamber assemblies listed in Table 401 use vaporisers B.498289, B499002 or B500553.

| Salvage No | | - | | |
|------------|-----------|-----------|-----------|------------|
| 3.497552 | B.934496, | B.934943, | B.934944, | (B.496634 |
| | | | B.935463, | (B.499266 |
| | B.936627, | B.936630, | B.936869, | (B.499267 |
| | B.936871, | B.936873, | B.936875, | (в.500556 |
| | B.936876, | B.936878, | B.936880, | (B.500557 |
| | B.936882, | B.938013, | в.938014, | |
| | B.938015, | B.938016, | B.938017, | |
| | в.938018. | B.938019, | B.938020. | |

Table 401



SECTION IDENTIFICATION

ITEM -3 (HEAD A/O) DOES NOT INCLUDE THE FOLLOWING ITEMS-36-37-38 AND -39

2BR Combustion Chamber Figure 401

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(2) Salvages identified in Table 402 may be used in any combination with Salvages in the range B935550-82.

NOTE: Combustion chamber assemblies listed in Table 402 use vaporiser 8.499243.

| Salvage | No. Assy. Part No. | | Replaced Parts | | |
|---------|--|---|---|---|---|
| B935552 | B.936867 B.936938 B.938173 B.938180 B.938183 B.938506 | B.936863, B.936884, B.938021, B.938178, B.938181, B.938501, B.938507, | B.936885, B.938022, B.938179, B.938182, B.938505, | (| B496634 B499266 B499267 B500556 B500557 |

Table 402

(3) Serviceable items may be re-used (Refer to paragraph 7). For repair of cracked front fairings, refer to Repair No.17.

3. <u>Instructions</u>

- A. Remove Shank Nuts and Vaporisers.
 - (1) Remove the vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.

FIGURE 402 CANCELLED

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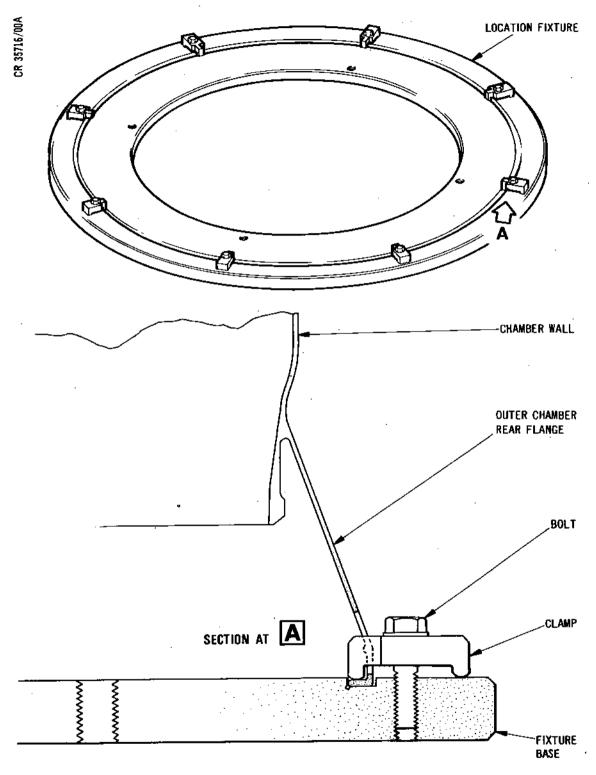


- (2) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 18 and 35, Fig.401 and 416). Care must be taken not to damage the flange. Refer to 72-09-00, Repair, for removal procedure.
- (3) Inspect to ensure satisfactory removal of shank nuts.
- B. Remove Head Assembly.

<u>CAUTION:</u> THE NO.2 INNER AND OUTER COOLING RINGS ARE THE FIRST COOLING RINGS BEHIND THE FRONT FAIRING.

- (1) Locate the chamber on its flanged end, on a surface table. Using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark two lines on the inner and outer No.2 cooling rings (Ref. dash items 30 and 34, Fig. 401), 0.200 in. (5,08 mm) from the weld line between the No.2 cooling rings and the adjacent sections (Ref. dash items 4 and 29, Fig. 401), 17.800 in. (452,12 mm) and 17.720 in. (450,09 mm) respectively from the datum A flange face (Ref. Fig. 401).
- (2) Identify the outer and inner chambers as a pair.
- (3) Locate the chamber in holding fixture ref. tool item 3 (Ref.Fig.403), using packing to support the inner chamber. Separate the chamber by cutting circumferentially around the two lines marked at para.(1), using a plasma torch and anti-spatter guard ref. tool item 4, or a mechanical cutter.
- (4) Remove items from fixture.
- (5) Clean up the inner and outer barrels to remove spatter beads. Ensure no thinning of parent metal occurs.
- (6) Inspect to ensure satisfactory removal of head assy.





Holding Fixture Ref. Tool Item 3 Figure 403

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C. Machine Outer Chamber.

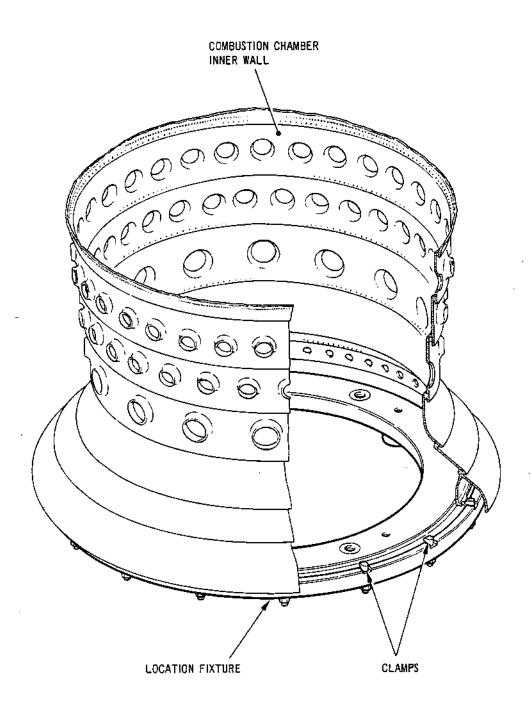
- (1) Locate outer chamber on a surface table on the rear outer flange (Ref. dash item 15), and using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark the 20.310 in. (515,87 mm) dimension shown at Fig.401.
- (2) Locate outer chamber to holding fixture ref. tool item 3 (Ref.Fig.403), and locate chamber/fixture assy. to a vertical centre lathe and set true.
- (3) Machine the outer chamber to an overall height of 20.310 in. (515,87 mm). Remove burrs.
- (4) Inspect to ensure 20.310 in. (515,87 mm) dimension has been achieved satisfactorily.
- (5) Crack test the outer chamber using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

D. Machine Inner Chamber.

- (1) Locate inner chamber on a surface table on the datum A flange face (Ref. dash item 18), and using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark the 17.600 in. (447,04 mm) dimension shown at Fig.401.
- (2) Locate inner chamber to holding fixture ref. tool item 5 (Ref.Fig.404), and locate chamber/fixture assy. to a vertical centre lathe. Set true.
- (3) Machine the inner chamber to an overall height of 17.600 in. (447,04 mm) from the datum A flange face (Ref.Fig.401). Remove burrs.
- (4) Inspect to ensure 17.600 in. (447,04 mm) dimension has been achieved satisfactorily.
- (5) Crack test the inner chamber using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- (6) Store the inner and outer chambers as required, keeping them as a matched pair.

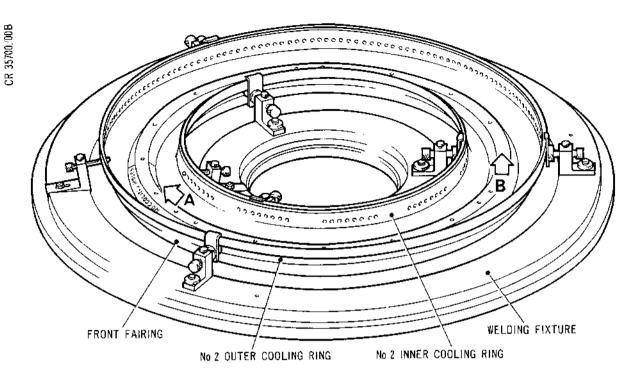
72-41-01

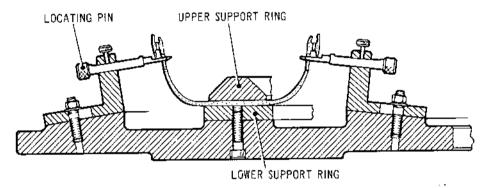




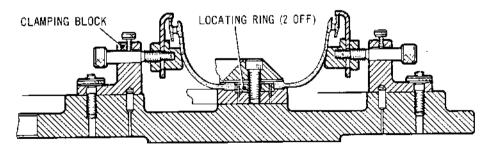
Holding Fixture Ref. Tool Item 5 Figure 404

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SECTION THROUGH LOCATING PINS AT ARROW A

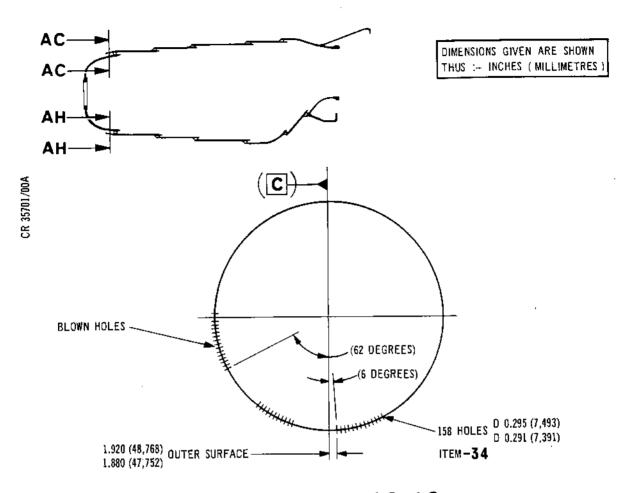


SECTION THROUGH CLAMPING BLOCKS AT ARROW B

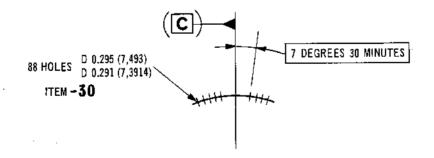
Welding Fixture Ref. Tool Item 6 Figure 405

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DIAGRAMMATIC SECTION AC-AC



DIAGRAMMATIC SECTION AH-AH

Blown Hole Details Figure 406

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- E. Attach Replacement Inner and Outer Cooling Rings to Front Fairing.
 - (1) Withdraw from stores replacement No.2 inner cooling ring B.499267 PDA, No.2 outer cooling ring B.499266 PDA and front fairing B.496634 PDA.
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease using a group 2, 3 or 4 solvent (Ref.72-09-00 - Cleaning).
 - (3) Assemble the replacement inner and outer No.2 cooling rings (Ref. dash items 30 and 34, Fig.401), to the front fairing using welding fixture ref. tool item 6 (Ref.Fig.405 and Service Bulletin OL.593-72-8801-310). Ensure the blown holes (Ref.Fig.406) are in the correct radial position, by locating the front fairing in the fixture, then locate the fixture upper support ring. The cooling rings are then located on the pins so that the areas where no blown holes exist correspond to the markings "NO COOLING HOLES" on the support ring. The location pins locate in the first hole of a set. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown in Fig.407.
 - (4) Tackweld, diametrically opposite, the replacement inner cooling ring to the front fairing, followed by the replacement outer cooling ring; refer to para.6, Process A, for welding data.
 - (5) Remove front fairing/cooling rings assy. from fixture.
 - (6) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the replacement cooling rings, then after dressing and cleaning, the tackwelding procedure repeated.
 - (7) Clamp the front fairing/cooling rings assy. to a welding table and autoweld the replacement inner cooling ring to the fairing, followed by the replacement outer cooling ring, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411); refer to para.6, Process A, for welding data.

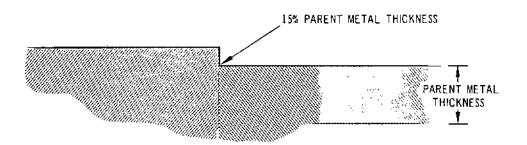
72-41-01

Repair No.7 Page 411 Jun 1/96 'X' PARENT METAL THICKNESS

SUM TOTAL 'X' + 'Y'
NOT TO EXCEED 30%
OF PARENT METAL

'Y' PARENT METAL THICKNESS

DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS



STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

Acceptable Mismatch Figure 407

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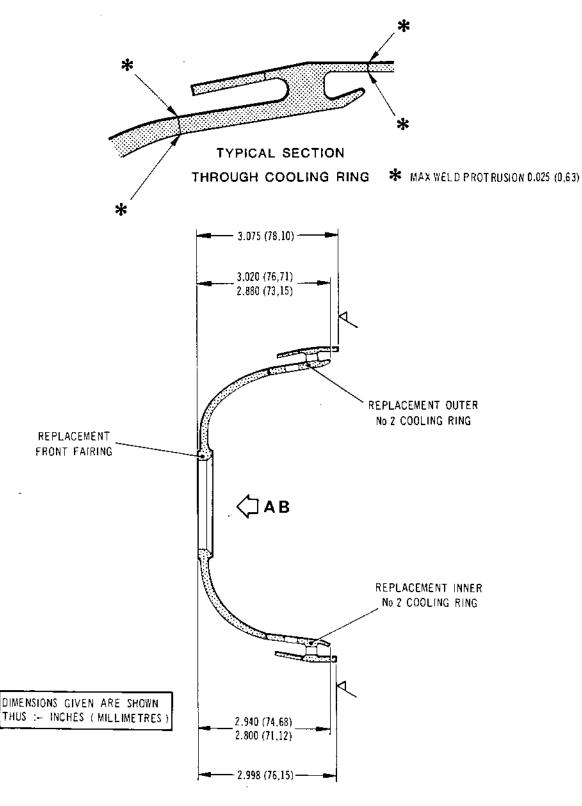
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- (8) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig. 408. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, then the replacement cooling ring must be removed by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (9) True up the head assembly to achieve the condition where all the vaporiser front location faces are in the same plane, using expanding shoe ref. tool item 25.
- (10) Inspect to ensure the 3.020/2.880 in. (76,71/73,15 mm) and 2.940/2.800 in. (74,68/71,12 mm) dimensions shown on Fig.408 have been achieved, and the welding has been carried out satisfactorily.
- (11) Crack test the front fairing assy. using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- F. Attach Replacement Inner and Outer Deflector Skirt Chamber Sections to No.2 Inner and Outer Cooling Rings.
 - (1) Withdraw from stores replacement outer deflector skirt chamber section B.500556 PDA and replacement inner deflector skirt chamber section B.500557 PDA.
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 Cleaning).
 - (3) Establish the vertical centre line of the front fairing assy. (Ref.Fig.406). Assemble the replacement inner and outer deflector skirts (Ref. dash items 31 and 32, Fig.401) to the cooling rings, ensuring the longitudinal welds in the skirts are positioned relative to the vertical centre line as shown in Fig.409, and the gaps between the skirts and the cooling rings (Ref.Fig.410) are maintained. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown in Fig.407.

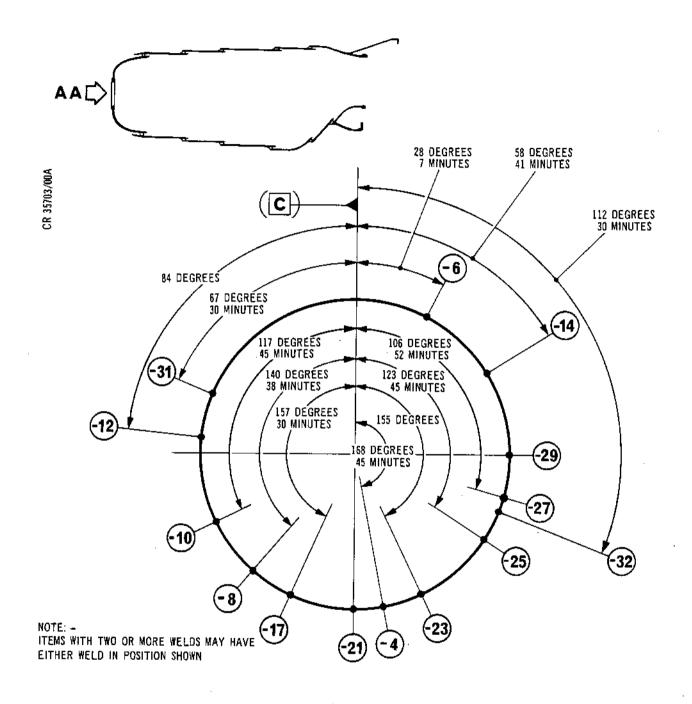
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Welding and Machining Details Figure 408

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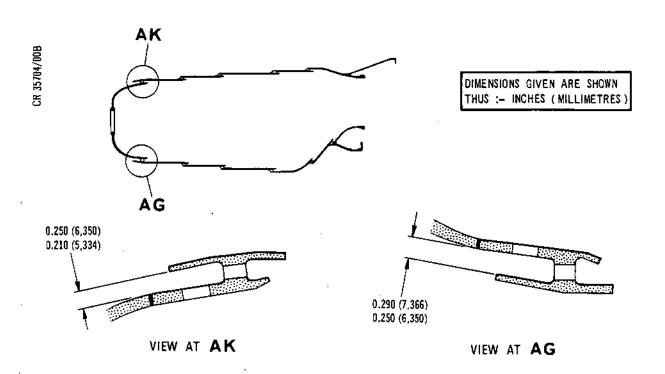
DIAGRAMMATIC VIEW IN DIRECTION OF ARROW AA
SHOWING ANGULAR POSITIONS OF LONGITUDINAL
WELDS IN THE ABOVE ITEMS

Angular Relationship of Longitudinal Welds Figure 409

REPAIR

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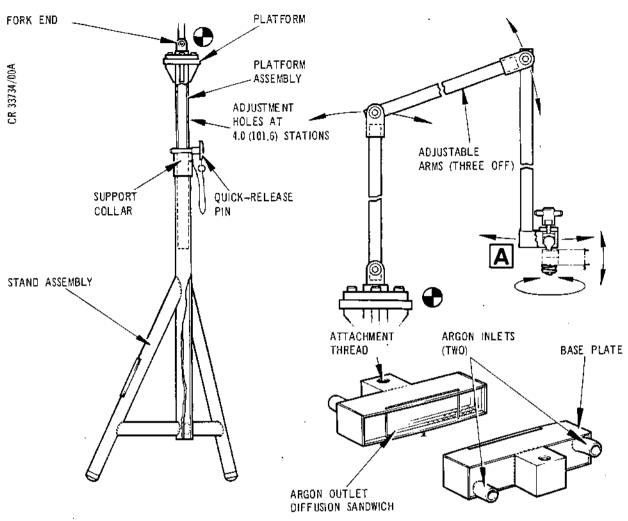


Cooling Ring Details Figure 410

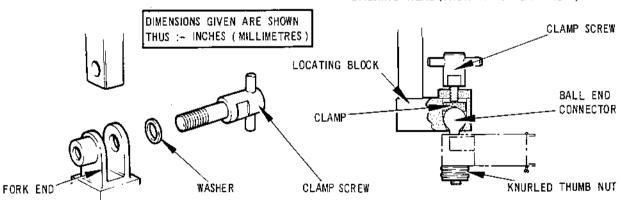
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- (4) Tackweld, diametrically opposite, the replacement outer deflector skirt to the outer cooling ring, followed by the inner deflector skirt, to the inner cooling ring using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411); refer to para.6, process B, for welding data.
- (5) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the replacement deflector skirts, then after dressing and cleaning, the tackwelding procedure repeated.
- (6) Clamp the head assembly to a welding table and autoweld the outer deflector skirt to the outer cooling ring, followed by the inner deflector skirt to the inner cooling ring, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411); refer to para.6, process B, for welding data.
- (7) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig. 408. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete rectify with a weld re-run.
- (8) Inspect to ensure the gaps shown at Fig. 410 have been maintained, and the welding has been carried out satisfactorily.
- (9) Dress and true up the deflector skirts if necessary using conventional hand tools.
- (10) Crack test the head assy. using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.





BACKING HEAD (FRONT AND REAR VIEW)



TYPICAL FORK END DETAIL

DETAIL **A**SHOWING BACKING HEAD ATTACHMENT

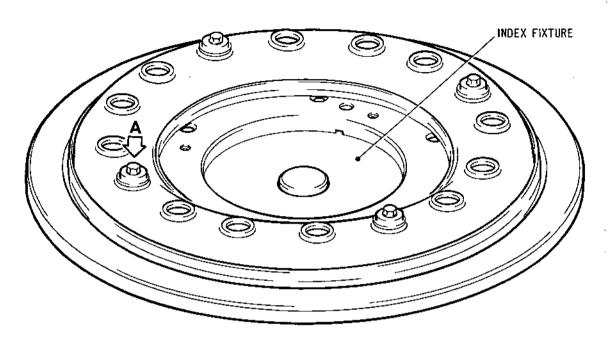
Argon Backing Stand and Head Ref. Tool Items 8 and 9 Figure 411

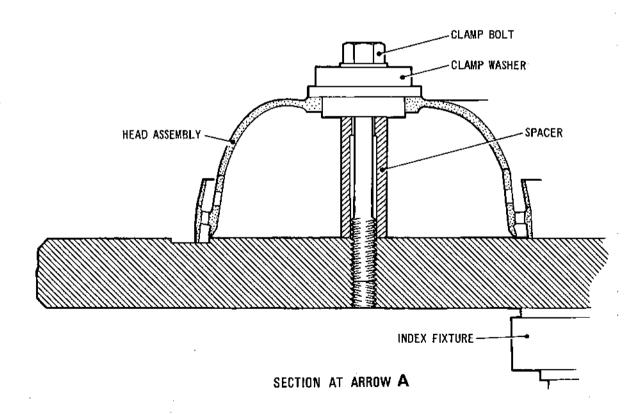
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G. Heat Treat.

- (1) Heat treat the head assy. to 1075 deg C plus/minus 5 deg C for 15 min. in a vacuum/argon furnace. Rapid inert gas quench.
- (2) Crack test the head assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- H. This operation cancelled.
- J. Machine Head Assembly. Alternative machining procedures are given in paragraphs (1) and (2). Paragraph (3) must follow either (1) or (2).
 - (1) Machine.
 - (a) Locate head assembly to vertical centre lathe and set true.
 - (b) Turn to produce the 2.998 in. (76,15 mm) and 3.075 in.(78,10 mm) dimensions shown on Fig.408. Deburr.
 - (c) Inspect to ensure the turning has been carried out satisfactorily.
 - (d) Locate head assembly in index fixture ref. tool item 7 (Ref.Fig.412), and locate component/ fixture assy. to a jig boring machine.
 - (e) Progressively bore to produce 12 equi-spaced vaporiser location holes 2.015/2.010 in. (51,18/51,05 mm) diameter. Face the 12 vaporiser front location faces producing the 0.020 in. (0,51 mm) dimension, and back face the 12 vaporiser rear location faces producing the 0.225/0.215 in. (5,71/5,46 mm) thickness. Chamfer the 16 vaporizer location holes on the rear face 0.050 in. (1,27 mm) by 45 degrees (Ref.Fig.413). Having machined all accessible positions, remove the four clamps, reverse clamp washers, locate at four previously machined positions, and complete machining at remaining four positions.
 - (f) Remove fixture/component assy. from machine and head assembly from fixture.

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Index Fixture Ref. Tool Item 7
 Figure 412

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- (g) Remove any burrs and sharp edges.
- (h) Inspect to ensure machining has been carried out satisfactority.

(2) Machine.

- (a) Locate index fixture ref. tool item 7 to a jig boring machine.
- (b) Locate the head assembly in the index fixture using modified spacers (BEOL tooling) at 4 locations in place of those supplied with the fixture.
- (c) Face the accessible front location faces to produce the 0.020 in. (0,51 mm) dimension (Ref.Fig.413). Move the head assembly round in the fixture, and machine the remaining 4 front locations.
- (d) Remove the head assembly from the fixture, and locate to a vertical centre lathe, front face downwards. Set true.
- (e) Machine the No.2 cooling rings to length to produce dimensions of 3.050 in. (77,47 mm) for the outer ring, and 2.973 in. (75,51 mm) for the inner ring.
 - NOTE: These dimensions correspond to the 3.075 in. (78,10 mm) and 2.998 in. (76,15 mm) dimensions given in Fig.408, but are 0.025 in. (0,64 mm) less, since the machining is carried out in a different order in this procedure.
- (f) Remove the head assembly from the lathe, and locate in the index fixture on the jig boring machine.
- (g) Bore out the accessible vaporiser location holes to 2.015/2.010 in. (51,18/51,05 mm) diameter (Ref.Fig.413). Move the head assembly round in the fixture, and bore out the remaining holes.



- (h) Remove the head assembly from the fixture, and remove the fixture from the jig boring machine.
- (j) Locate the head assembly, front face down, to the jig boring machine.
- (k) Face the rear location faces to produce the 0.225/0.215 in. (5,72/5,46 mm) dimensions, then chamfer 0.050 in. (1,27 mm) by 45 deg. (Ref.Fig.413).
- (1) Remove the head assembly from the machine.
- (m) Remove burrs and sharp edges.
- (n) Inspect to ensure that machining has been carried out satisfactorily

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CR 35706/00B

2.395 (60,833)

D 0.020 (0,508) B C

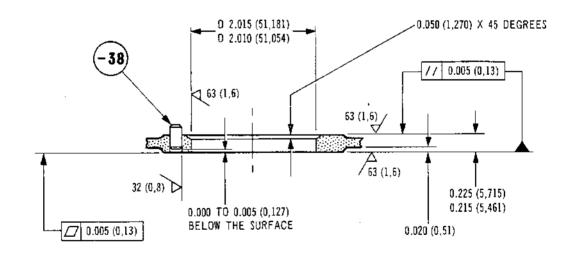
16 HOLES EQUALLY SPACED

10 0.005 (0,127) F

32 HOLES D 0.1972 (5,009)
D 0.1955 (4,991)
IN 16 GROUPS OF 2

15.100 (383,540)
TO CENTRE LINE

VIEW IN DIRECTION OF ARROW AB (REF FIG 408)



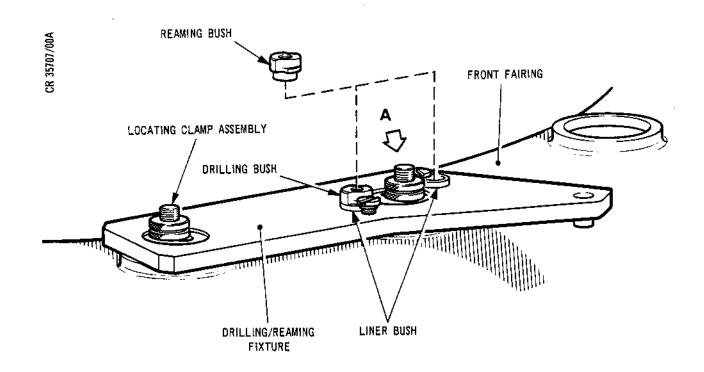
SECTION AN-AN

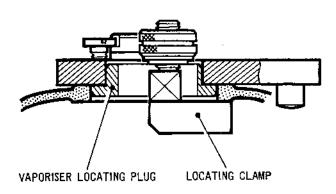
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Machining Details of Vaporiser Locations Figure 413

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ENLARGED SECTION AT ARROW A

Drill Jig Ref. Tool Item 12 Figure 414

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(3) Drill.

- (a) Locate head assembly to a drilling machine, and locate drill jig ref. tool item 12 (Ref.Fig.414) to head. Drill two holes in position 0.1875 in. (4,763 mm) diameter using relevant slip bush. Remove slip bush and replace with larger size bush and ream holes to 0.1972/0.1965 in. (5,009/4,991 mm) diameter, using reamer ref. tool item 13. Repositioning the drill jig after production of each pair of holes completely drill 16 groups of two holes (Ref.Fig.413).
- (b) Remove burrs produced at previous operation.
- (c) Inspect to ensure holes have been produced satisfactorily using gauge kit ref. tool item 14.
- (d) Crack test the head assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

K. Apply Coatings.

- (1) Plasma spray the inner and outer No.2 cooling rings as instructed in Chapter 72-41-01, Repair No.14.
- (2) For combustion chamber assemblies where the head assembly was coated with Sermaloy J prior to this repair (Ref. SB.72-8822-315 or SB.72-8850-321), apply a coating on the new head assembly as instructed in Chapter 72-41-01 Repair No.19.
- L. Attach Inner and Outer Chambers to Head Assy.
 - (1) Withdraw from stores the inner and outer chambers stored as a pair at para.3.0.(5).
 - (2) Remove the existing vaporiser seating pads from fixture ref. tool item 15 (Ref.Fig.415), and store in container ref. tool item 17. Attach the location and support blocks in adapter set ref. tool item 16 (Ref.Fig.415) to fixture.

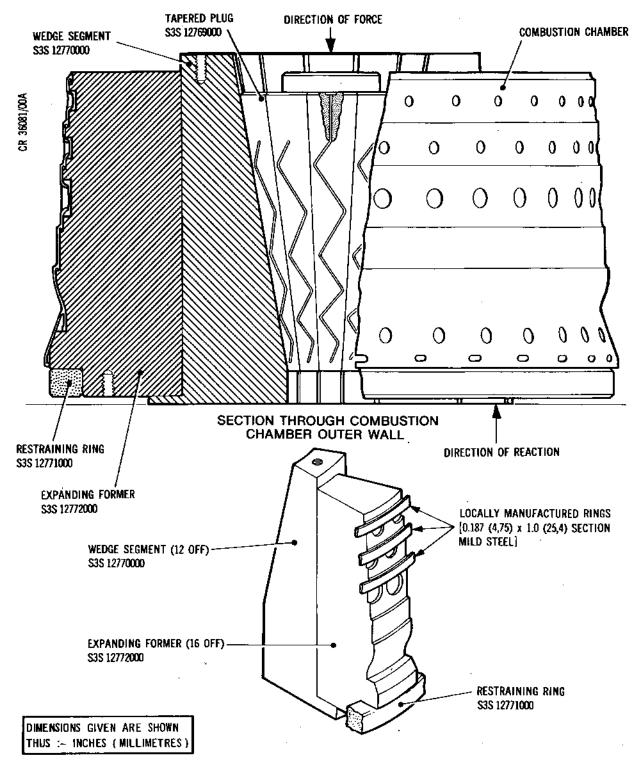
NOTE:

When replacing sections of the combustion chamber, it is usually necessary to expand existing sections to match the replaced part, prior to welding. Expansion is carried out on the particular area, adjacent to that being replaced. This is achieved by using segmented, or split rings of local manufacture. (Use tools, ref. items 26, 27, 28, 29, para.4 and Figure 414A for outer chamber and items 26, 30, 31, 32, para.4 and Figure 414B for inner chamber.)

- (3) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 - Cleaning).
- (4) Assemble the inner chamber to the head assembly using welding fixture ref. tool item 15 with adapter set ref. tool item 16 fitted (Ref.Fig.415). Ensure the longitudinal welds are in the correct position as shown at Fig.409. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown in Fig.407.
 - NOTE: The inner chamber must be located in the fixture using the four dowel holes shown at section BA (Ref.Fig.416). It may be necessary to shim under the vaporiser location positions to remove any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 in. (0.762 mm) at any one position.
- (5) Tackweld, diametrically opposite, the inner chamber to the head assembly using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411); refer to para.6 process C for welding data.
- (6) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the head assembly from the inner chamber, and after dressing and cleaning, the tackwelding procedure repeated.

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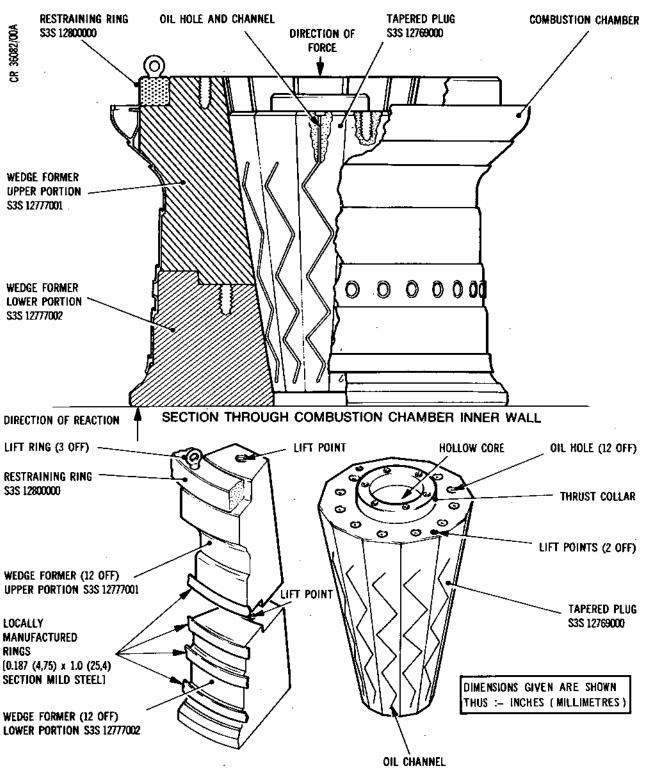




Expanding Equipment - Outer Chamber Figure 414A

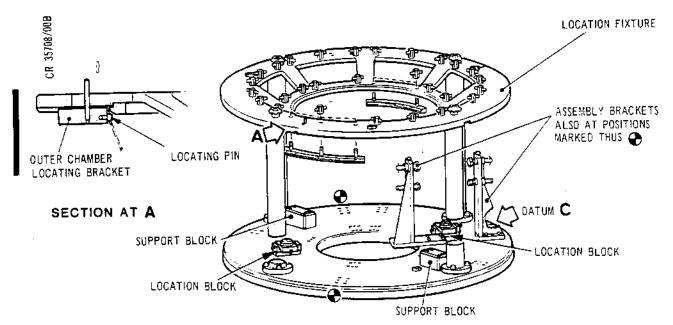
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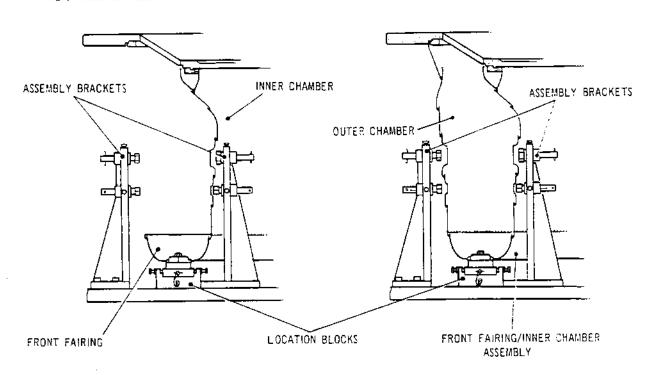


Expanding Equipment - Inner Chamber Figure 414B

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NOTE: ALTHOUGH THE ASSEMBLY BRACKETS ARE USED TO ACHIEVE THE CORRECT ANGULAR RELATIONSHIP OF THE INDIVIDUAL PARTS THEY MUST BE USED IN CONNECTION WITH THE STAGGERED WELD DIAGRAM (REF FIG 409)



Welding Fixture and Adapter Set Ref. Tool Items 15 and 16 Figure 415

REPAIR

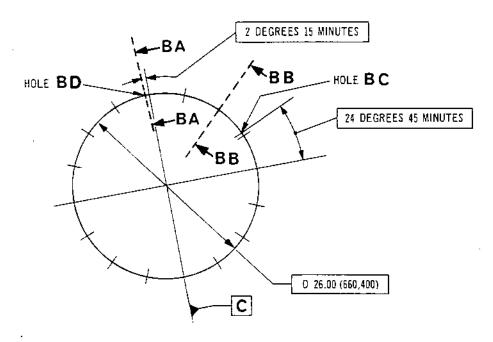
72-41-01

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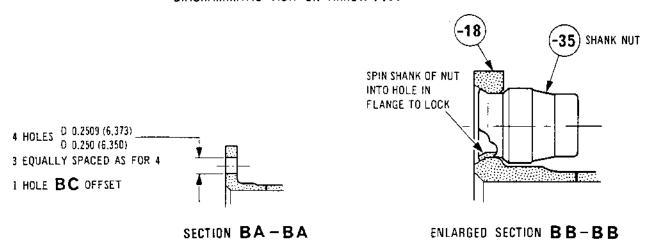


Ch 35709/00A

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



DIAGRAMMATIC VIEW ON ARROW A X



Dowel Hole Details Figure 416

REPAIR

72-41-01

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CR 35710/000

HEAD ASSY SERIAL NO TO BE MARKED HERE (SUFFIX LETTER B)

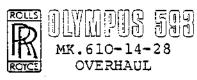
FACE AZ COMBUSTION CHAMBER ASSY DIMENSIONS GIVEN ARE SHOWN No MARKED HERE THUS :- INCHES (MILLIMETRES) **‡** 2.710 (68,83) - 15 2.650 (67,31) OUTER CHAMBER SERIAL No MARKED HERE (SUFFIX LETTER A) INNER CHAMBER SERIAL No MARKED HERE (SUFFIX LETTER C) 20.620 (523,748) 20.520 (521,208) Z Z

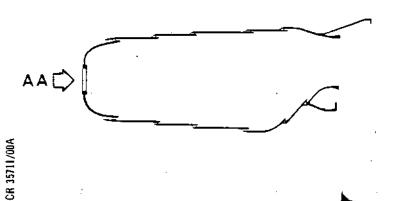
+ MEASURE FROM MEAN OF FLANGE SWASH MAXIMUM TOTAL SWASH 0,060 (1,52)

Dimensional and Marking Details Figure 417

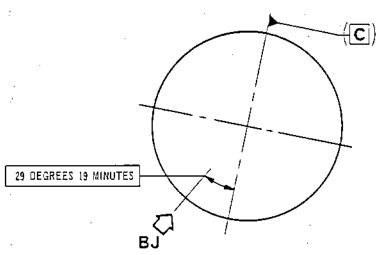
FRONT FAIRING

72-41-01 Repair No.7 Page 427 Sep 1/83

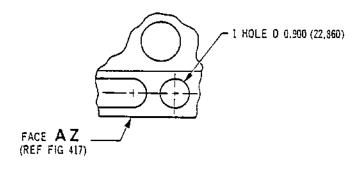




DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



DIAGRAMMATIC VIEW IN DIRECTION OF ARROW AA



VIEW IN DIRECTION OF ARROW BJ

Hole Details Figure 418

72-41-01

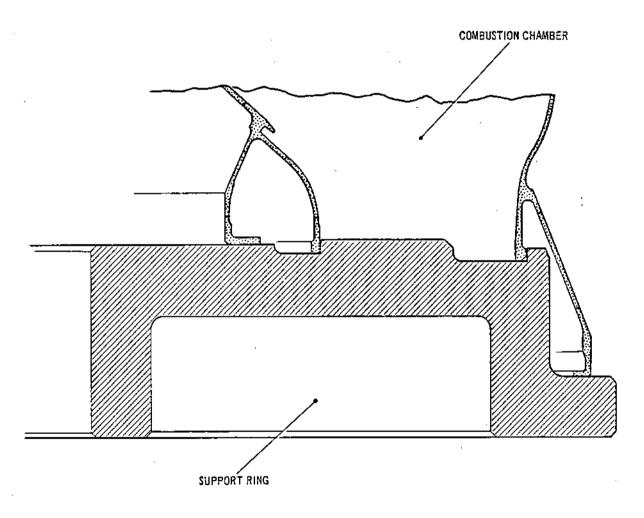
Repair No.7 Page 428 Mar 1/81

- (7) Remove the head/inner chamber assy. from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411), autoweld the head assembly to the inner chamber; refer to para.6, process C for welding data.
- (8) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig. 408. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning or parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the inner chamber must be removed from the head assembly by plasma cutting and machining, as detailed previously, and the whole procedure repeated.
- (9) Inspect to ensure the 20.620/20.520 in. (523,748/521,208 mm) dimension shown at Fig.417 has been achieved and that the welding has been carried out satisfactorily.
- (10) Crack test the head/inner chamber assy. using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- (11) Assemble the outer chamber to the head/inner chamber assy. using welding fixture ref. tool item 15, with adaptor set ref. tool item 16 fitted (Ref.Fig.415). Ensure the longitudinal welds are in the correct position as shown at Fig.409. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown at Fig.407.

NOTE: The head/inner chamber assy. is located in the fixture using the dowels and shimming as previously detailed at para.3.L.(4). The outer chamber is located using the fixture locating pin (Ref. section A, Fig.415), engaged in the 0.900 in. (22,860 mm) diameter hole (Ref.Fig.418). It may be necessary to wedge up the outer head assembly slightly to overcome any slight swash present and achieve a good mating fit at the joint surfaces. Care must be taken not to damage the head assembly outer skin.

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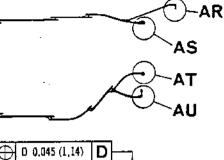
- (12) Tackweld diametrically opposite, the head/inner chamber assy. to the outer chamber, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411); refer to para.6, process D for welding data.
- (13) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the head/inner chamber assy. from the outer chamber, and after dressing and cleaning, the tackwelding procedure repeated.
- (14) Remove the combustion chamber assy, from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref.Fig.411), autoweld the head/inner chamber assy, to the outer chamber; refer to para.6, process D for welding data.
- (15) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig.408. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the inner chamber/head assy. must be removed from the outer chamber by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (16) Inspect to ensure the 2.710/2.650 in. (68,83/67,31 mm) dimension shown at Fig.417 has been achieved, and that the welding has been carried out satisfactorily.
- (17) Crack test the chamber using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

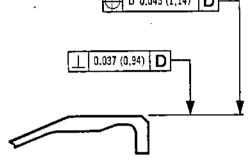


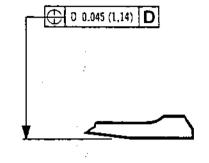
Support Ring Ref. Tool Item 18 Figure 419

72-41-01

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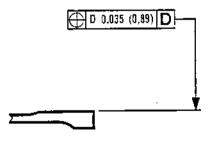




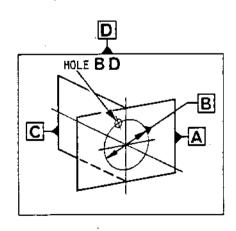


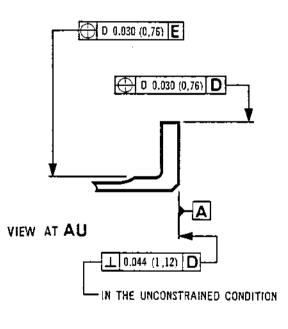
VIEW AT AS

VIEW AT AR



VIEW AT AT





DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Tolerance Details Figure 420

72-41-01

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M. Heat Treat.

- (1) Locate chamber to heat treatment support ring ref. tool item 18 (Ref.Fig.419) and place component/ fixture assy. in a vacuum/argon furnace.
- (2) Heat treat chamber to 800 deg C. plus/minus 5 deg C for 8 hours. Rapid inert gas quench.
- (3) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- N. True up Chamber.
 - (1) Generally true up the chamber, using standard shop tools to achieve the tolerances shown at Fig. 420.
 - (2) Crack test the chamber using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- P. Assemble Vaporisers.
 - (1) Withdraw from stores 32 pins AS_20669.
 - (2) Shrink fit two pins in position (Ref. dash item 38, Fig.401 and 413), in the 0.1972/0.1965 in. (5,009/4,991 mm) holes at the 16 vaporiser positions. The pins must be 0.000 to 0.005 in. (0,000 to 0,127 mm) below the fairing front face.
 - (3) Withdraw from stores the serviceable vaporisers and retaining nuts removed at para.3.A. If necessary, withdraw additional vaporisers and retaining nuts to make up a total set of 16.
 - NOTE: Assemblies listed in Table 401 use vaporisers B498289 (preferred) or B499002 or B500553. Assemblies listed in Table 402 use vaporisers B499243.
 - (4) Assemble the 16 vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.



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- Q. Install Shank Nuts.
 - (1) Withdraw from stores 16 shank nuts AS.27871.
 - (2) Locate the shank nuts (Ref. dash item 35, Fig.401 and 416) progressively to rear flange (Ref. dash item 18, Fig.401), and swage over into the countersunk holes, using swaging tool ref. tool item 22; refer to Chapter 72-09-00, Repair, for installation procedure.
 - (3) Inspect to ensure satisfactory installation of shank nuts.
- R. Inspect.
 - (1) Test the chamber for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- S. Identify.
 - (1) Allocate and mark the replacement head assy. serial number and mark the number SAL_B.497552 or B.935552 as appropriate (Ref. Tables 401, 402) adjacent the existing assy. part number at the positions indicated on Fig.417, using the electro chemical or vibro percussion marking technique detailed in Chapter 72-09-00, Repair.
 - (2) For combustion chamber assemblies to pre. SB 72-8850-321 standard that have been coated with Sermaloy J during this repair, line through the existing assembly part number and mark on the appropriate new number (Ref. Chapter 72-41-01 Repair No.19).



T. Finally Inspect.

- (1) Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.
- (2) Generally clean the chamber to remove grease and foreign bodies, then place the chamber in container Ref. Tool Item 23.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u>Item</u> | <u>Fig.No.</u> |
|---------------------|----------|----------------------|-------------|----------------|
| Impact Wrench | 1 | \$3 \$.15906000 | 1 | - |
| Socket Wrench | 1 | \$3 S. 15 90 7 0 0 0 | 2 | - |
| Holding Fixture | 1 | \$3 \$.15231000 | 3 | 403 |
| Anti-spatter Guard | 1 | 83 8.1591 9000 | . 4 | - |
| Holding Fixture | 1 | S3 S. 1 2437000 | 5 | 404 |
| Welding Fixture | 1 | S3 S.15923000 | . 6 | 40.5 |
| Index Fixture | 1 | s3 s.15924000 | 7 | 412 |
| Argon Backing Stand | 1 | s3 s.12445000 | 8 | 411 |
| Argon Backing Head | 1 | s3 s.12446000 | 9 | 411 |
| Cancelled | | | 10 | - |
| Cancelled | | | 11 | - |
| Drill Jig | 1 | S3 S.15925000 | 12 | 41 4 |
| Reamer | 1 | S3 S.15944000 | 13 | - |
| Gauge Kit | 1 | \$3 \$.15926000 | 14 | . - |
| Welding Fixture | 1 | s3 s.12431000 | 15 | 415 |
| Adaptor Set | 1 | s3 s.15910000 | 16 | 415 |
| Container | 1 - | \$3 S.15936000 | 17 | |
| Support Ring | 1 | s3 s.1 243 9000 | 18 | 419 |
| Socket Wrench | 1 | s3 s. 15 90 80 00 | 19 | _ |
| Peening Tool | 1 | s3 s. 15917000 | 20 | - |
| Riveting Dolly | 1 | \$3 \$.1591 8000 | 21 | - |
| Swaging Tool | 1 | s3 s. 12440000 | 22 | •• |
| Container | 1 | s3 s. 116 98000 | 23 | - |
| Cancelled | 1 | | 24 | - |
| Expanding Shoe | 1 | S3 S. 14014000 | 25 | |
| Tapered Plug | 1 | S3 S.12769000 | 26 | (414A |
| | · . | | 27 | (414B |
| Wedge Segment | 12 | S3 S. 1 277 0000 | 27 | 414A |
| Restraining Ring | . 1 | s3 s. 1277 1000 | 28 | 414A |
| Expanding Former | 16 | s3 s.1277 2000 | 29 | 41 4 A |
| Wedge Former | 12 | \$3 \$.1 2777 001 | 3 O | 41 4B |
| Wedge Former | 12 | S3 S.12777002 | 31 | 414B |
| Restraining Ring | 1 | S3 S.12800000 | 32 | 414B |

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5. Replacement Parts

| Description | Quantity | | Part No. | I.P.C. | Fig./ Item |
|---------------------------------------|----------|----|--------------|----------------------|---------------|
| No.2 Inner Cooling Ring | 1 . | | B.499267 PDA | 72-41-01 | 2/120 |
| No.2 Outer Cooling Ring | 1 | | B.499266 PDA | 72-41-01 | 2/110 |
| Front Fairing Outer Deflector Skirt | 1 | | B.496634 PDA | 72-41-01 | 2/100 |
| Chamber Section Inner Deflector Skirt | 1 | | 8.500556 PDA | 72-41-01 | 2/130 |
| Chamber Section | 1 | | B.500557 PDA | 72-41-01 72-41-01 | |
| Pins | 32 | | AS.20669 | | |
| Vaporisers | A/R | | B.498289 | 72-41-01 | |
| | | | B.499002 | 72-41-01 | |
| | | | B.500553 | 72-41-01 | 2/50 |
| | | or | B.499243 | 72-41-01 | |
| Retaining Nuts | A/R | | B.495785 | 72-41-01 | 2/30 |
| Rivets | 32 | | AS.16258 | 72-41-01 | 2/20 |
| Shank Nuts | 16 | | AS.27871 | 72-41-01 | 2/410 |

6. Welding Data

A. Process A.

(1) Method of Welding:

Automatic circumferential argon arc butt.

(2) Machine:

Analog 300.

(3) Positioner:

Aga.

(4) Torch:

W400 water cooled.

(5) Electrode:

0.125 in. (3,175 mm) thoriated tungsten.

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- (6) Arc Length:
 0.030 in. (0,76 mm).
- (7) Weld Speed:
 4.500 in./min. (114,3 mm/min.).
- (8) Current: 130 amps.
- (9) Pulsing:
 - (a) Background Current: 30 amps.
 - (b) Pulse Time:
 Two pulses per sec.
 - (c) Pulse Width:
 40 per cent on.
- (10) Torch Gas:

15 cu ft/hr (7,5 litres/min.) Argon plus five per cent Hydrogen at 15 psi (103 kPa).

(11) Shroud Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(12) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(13) Filler wire:

16 s.w.g. MSRR 9500/16.

(14) Direction of weld from outside.

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B. Process B.

- (1) Method of Welding: Automatic circumferential argon arc butt.
- (2) Machine:
 Analog 300.
- (3) Positioner: Bode.
- (4) Torch:
 Interlas model 301, Water cooled.
- (5) Electrode:
 0.125 in. (3,175 mm) thoriated tungsten.
- (6) Arc Length: 0.040 in. (1,02 mm).
- (7) Weld Speed:
 6.0 in./min. (152,4 mm/min.).
- (8) Current:
 75 amps.
- (9) Torch Gas:
 25 cu ft/hr (12 litres/min.) Argon at 30 psi
 (206 kPa).
- (10) Shroud Gas:
 25 cu ft/hr (12 litres/min.) Argon at 30 psi
 (206 kPa).

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(11) Backing Gas:

50 cu ft/hr (25 litres/min.) Argon at 30 psi (206 kPa).

(12) Filler wire:

16 s.w.g. MSRR 9500/16.

(13) Direction of weld from outside.

C. Process C.

(1) Method of Welding:
Automatic circumferential argon arc butt.

(2) Machine:
Analog 300.

(3) Positioner:

Aga.

(4) Torch:
Interlas 301 water cooled.

(5) Electrode:
 0.125 in. (3,175 mm) thoriated tungsten.

(6) Arc Length:
 0.040 in. (1,02 mm).

(7) Weld Speed: 7.0 in./min. (177,8 mm/min.).

(8) Current: 70-74 amps.

(9) Downslope Time:
10 sec.

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(10) Torch Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(11) Shroud Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(12) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(13) Filler wire:

16 s.w.g. MSRR 9500/16.

(14) Direction of weld from outside.

- D. Process D.
 - (1) Method of Welding:
 Automatic circumferential argon arc butt.
 - (2) Machine:

Analog 300.

(3) Positioner:

Aga.

(4) Torch:

M301.

(5) Electrode:

0.125 in. (3,175 mm) thoriated tungsten.

(6) Arc Length:

0.030 in. (0.76 mm).

(7) Weld Speed:

5.0 in./min. (127,0 mm/min.).

(8) Current:

70 amps.

(9) Torch Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(10) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(11) Filler wire:

16 s.w.g. MSRR 9500/16.

(12) Direction of weld from outside.

7. Serviceable Items

- A. When re-using serviceable items where the weld joint has been plasma sprayed, proceed as follows:
 - (1) Dry abrasive blast using aluminium oxide grit 18/24 mesh to remove the top two coats of magnesium zirconate for a distance of 0.250 in. (6,35 mm) from the joint. Refer to 72-09-24 Repair for procedure.
 - (2) Prepare the edge for welding using an aluminium oxide scurf mop.
 - (3) Autoweld the serviceable item as instructed in this Repair.
 - (4) Inspect visually.
 - NOTE: The unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burr or an aluminium oxide scurf mop.
 - (5) Crack test the welded items using the fluorescent dye penetrant process specified in this Repair.
 REPAIR

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CHAMBER, ASSEMBLY, COMBUSTION

REPLACEMENT OF VAPORISERS

B517613

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | <u>Part No.</u> |
|------------|-------------|--------------------|
| 72-41-01 | 2 10N | в938173 |
| | 10R | B512865 |
| | 108 | B513927 |
| | 10т | B514702 B514706 |
| | 100 | 8516665 8517450 |
| | 10 v | 8516671 8517452 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125(3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

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REPAIR

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

Remove Vaporisers.

1) Carefully remove the securing rivets from the Vaporiser retaining nuts (ref items 2 and 4) as follows. Refer to Figs. 401 and 402.

(a) Drill through the formed head of the rivet using a drill of slightly smaller diameter than the rivet shank (i.e. a No.42 or 2,35 mm drill). Spinning of the rivet when drilling should be prevented as this tends to enlarge the rivet hole.

- (b) Break off the rivet head using a drift.
- (c) Support the vaporiser and retaining nut with a reaction block and drive out the rivet using a pin of slightly smaller diameter than the diameter of the rivet shank.
 - (d) Visually inspect to ensure satisfactory removal of rivets.
- Remove the 16 retaining nuts as follows.
 - (a) Assemble the vaporiser restraining tool to the inside of the combustion chamber. Ensure that the four holes in each of the four quadrants locate squarely over the vaporisers before bolting the retaining ring to the rear flange (ref item 5).

Refer to para.7.Tools item 1.
Refer to Fig.401.

(b) Remove the 16 retaining nuts using impact wrench and socket wrench. Refer to para.7.Tools items 2 and 3.

- (c) Remove the restraining tool.
- (d) Remove the vaporisers.

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- (3) Visually inspect each vaporiser and retaining nut for serviceability.
- (4) Fluorescent dye penetrant inspect each vaporiser and retaining nut.

Refer to Overhaul Manual Chapter 72-41-01 Inspection / Check.

(5) Place serviceable parts in a protective container, identify as part of chamber assembly and store for re-use.

Check Vaporiser Location Pins.

(6) Visually inspect the two vaporiser location pins at the 16 vaporiser positions for damage and that they are 0.000 to 0.005 (0,00 to 0,13) below the fairing front face. Refer to Fig. 402.

(7) If necessary, remove any damaged vaporiser location pins and replace by shrink fitting. Refer to Fig. 402.
Refer to para.8. Replacement
Parts, item 3.

Assemble Vaporisers.

(8) Withdraw from stores the serviceable vaporisers and retaining nuts removed at para.4.0P.5. If necessary withdraw additional vaporisers to make a set of 16.

Refer to para.8 Replacement Parts, items 1 and 2.

- (9) Clean the threads on vaporisers and retaining nuts.
- (10) Apply lubricant to vaporiser threads and abutment face of nuts, using only a sufficient amount for complete coverage.

Use OMat 4/62.

REPAIR

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- (11) Assemble each vaporiser in turn for a pin stand-out check as follows.
 - (a) Assemble the vaporiser to the combustion chamber locating on the 2 pins.
 - (b) Place the trial assembly tool over the thread of the vaporiser, ensuring that the two slots line up with the two pins.

Refer to para.7.Tools item 4.

- (c) Assemble the nut onto the vaporiser and torque-tighten to 200 lbf ft (271,20 Nm), ensuring that the slots in the trial assembly tool remain in line with the two pins.
- (d) Disassemble the nut and remove the trial assembly tool.
- (e) Check that the pins are flush or below the fairing front face. If not, dress the pins flush before final assembly.

Refer to Fig. 402.

(12) Note the position of any existing holes if re-using vaporisers. Selectively assemble retaining nuts to vaporisers, and using socket wrench, torque-tighten the nuts to 200 lbf ft (271,20 Nm) then slacken the nut. Finally torque-tighten to 200 lbf ft ± 2% (271,20 Nm ± 2%). Refer to para.7.Tools item 5.

- (13) Visually inspect to ensure satisfactory assembly of vaporisers.
- (14) Peen to lock the 16 vaporiser retaining nuts in position using peening tool.

Refer to Fig. 402. Refer to para.7.Tools item 6.

REPAIR

72-41-01 Repair No.8 Page 404 Jun 1/98 (15) Visually inspect to ensure satisfactory peening of retaining nuts.

prill the rivet holes

Note: Existing holes in retaining nuts may be re-used, but existing holes in vaporisers must not be re-used.

New holes in vaporisers must positioned at least 30° away from existing hole.

(16) Drill 1 hole in each vaporiser using drilling fixture.

Refer to Fig. 402.
Refer to para.7.Tools
item 7.
Refer to Service Bulletin
0L.593-72-8818-312 for
procedure, but drill only
one hole in each vaporiser.

- (17) Visually inspect to ensure satisfactory drilling.
- (18) Withdraw from stores 16 off rivets.
- (19) Secure the rivets (ref.item 4) at 16 vaporiser positions through retaining nuts and vaporisers. Use riveting dolly and standard hand tools to close the rivets. A few heavy blows should be used rather than many light ones. Numerous light blows tend to work harden the rivets, thus increasing the risk of cracking.
- (20) Inspect to ensure satisfactory riveting. The following conditions must exist.
 - (a) The rivet must be tight.
 - (b) The formed head must be free from cracks and signs of bursting at the periphery.
 - (c) Both the rivet heads must be correctly seated.

Refer to para.8. Replacement Parts, item 4.

Refer to Figs. 401 and 402. Refer to para. 7. Tools item 8.

- (d) The formed head shall not be offset from the head.
- (e) There shall be no distortion or marking of the components within the vicinity of the rivet.

Inspect

(21) Fluorescent dye penetrant inspect the vaporiser area for cracks. Refer to Overhaul Manual Chapter 72-41-01 Inspection /Check.

Identify

(22) Mark Repair Instruction number RI B517613 or R8 on component, adjacent to normal assembly number, using the vibropercussion engraving technique. Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

| COMPONENT | MATERIAL | RR CODE |
|-------------------------------|--------------------------------|----------------|
| CHAMBER, ASSEMBLY, COMBUSTION | C263 MSRR 7038 MSRR 7036 | Q A U Q A R |

6. DATA

NONE.

7. TOOLS

| TOOL NUMBER | DESCRIPTION | <u>ITEM</u> |
|---------------|---------------------|-------------|
| s3s14001000 | Restraining Tool | 1 |
| \$3\$15906000 | Impact Wrench | 2 |
| \$3\$15907000 | Socket Wrench | 3 |
| \$3\$90364000 | Trial Assembly Tool | 4 |
| \$3\$15908000 | Socket Wrench | 5 |
| S3S15917000 | Peening Tool | 6. |
| \$3\$13824000 | Drilling Fixture | 7 |
| S3S15918000 | Riveting Dolly | 8 |

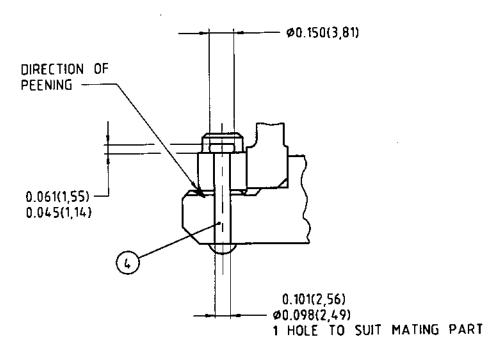
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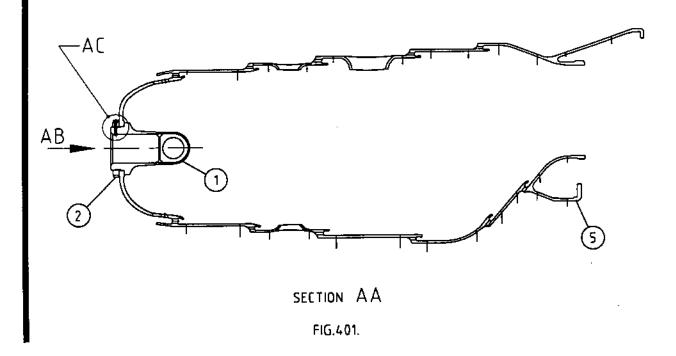
8. REPLACEMENT PARTS

| PART NUMBER | <u>DESCRIPTION</u> | <u>QUANTITY</u> | ITEM |
|-------------|--------------------|-----------------|------|
| B499243 | Vaporiser | A/R | 1 |
| B495785 | Retaining Nut | A/R | 2 |
| AS20669 | Pin | A/R | 3 |
| AS16258 | Rivet | 16 | 4 |



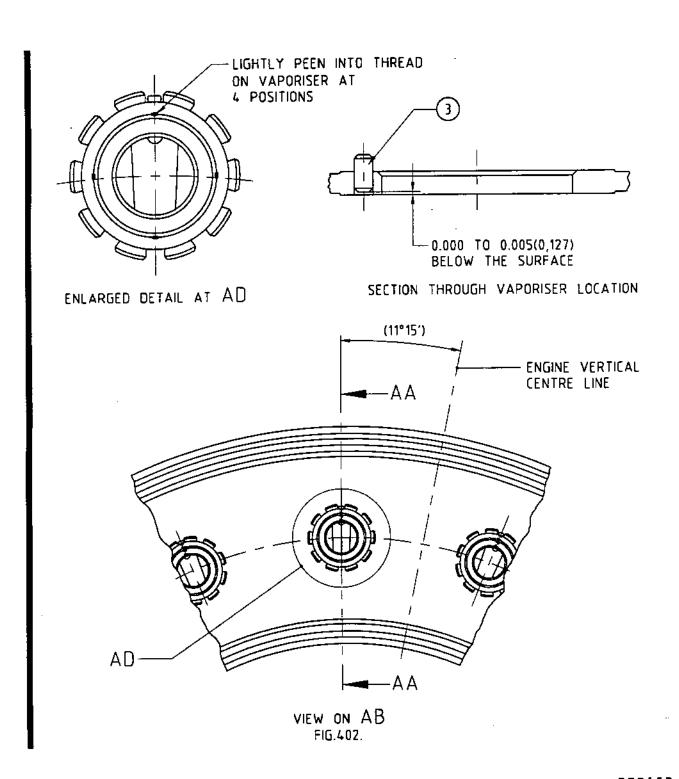


ENLARGED DETAIL AT AC



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COMBUSTION CHAMBER (2BR) - REPAIR REPLACEMENT OF NO.3 INNER COOLING RING AND ADJACENT INNER FRONT CHAMBER SECTION

MODIFICATION NO. OL.8744C, OL.8851C

Effectivity

| I.P.C. | Fig./Item | | Part No. | |
|----------|-----------|---|---|--|
| 72-41-01 | | B.934945, B.936627, B.936863, B.936869, B.936875, B.936885, B.938014, B.938017, B.938020, B.938173, B.938183, | B.934943, B.935462, B.936630, B.936865, B.936871, B.936876, B.936938, B.938015, B.938015, B.938021, B.938178, B.938510, B.938510, | B.935463, B.936862, B.936867, B.936873, B.936878, B.938013, B.938016, B.938019, B.938022, B.938179, B.938182, B.938505, |

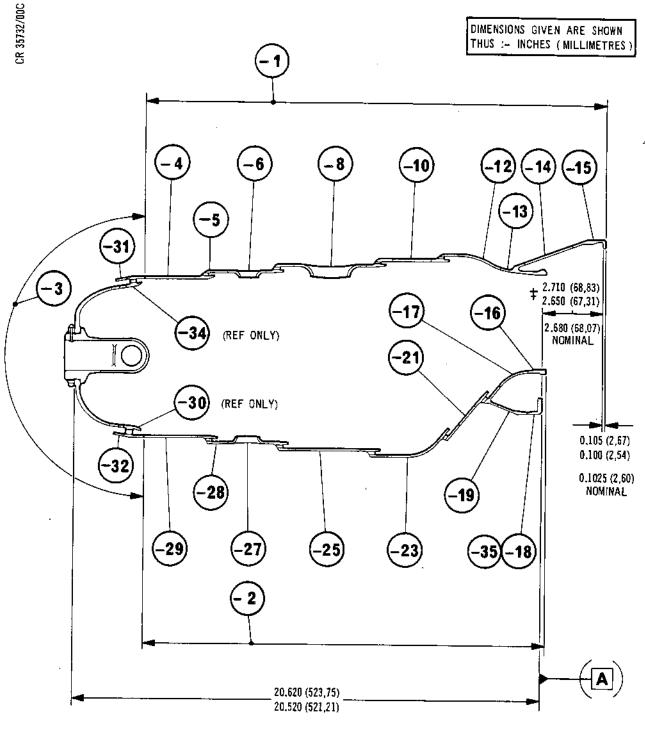
2. Introduction

A. General

- (1) This repair describes the procedure for replacing the combustion chamber No.3 inner cooling ring, and adjacent inner front chamber section to restore the chamber to a serviceable condition.
- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,81 mm) unless otherwise stated.
- (5) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (6) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.

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† MEASURE FROM MEAN OF FLANGE SWASH MAXIMUM TOTAL SWASH 0.060 (1,52)

Combustion Chamber Details Figure 401

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- (7) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) After welding, ovality and shrinkage on items indicated Z (Ref.Fig.414) may be up to minus 0.240 in. (6,096 mm) on diameter.
- (10) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.
- (11) All welds are classified as Group 2.
- B. Repair Limitations.
 - (1) Salvages identified in Table 401 may be used in any combination with Salvages in the range B497550-89.

| Salvage No. | Assy. Part No. | Replaced Parts |
|-------------|---|----------------|
| B.497578-9 | B.934496, B.934943, B.934944, | (B.497195 |
| | B.934945, B.935462, B.935463, B.936627, B.936630, B.936869, | (B.495/32 |
| | B.936871, B.936873, B.936875, | |
| | B.936876, B.936878, B.936880, B.936882, B.938013, B.938014, | |
| | B.938015, B.938016, B.938017, | |
| | B.938018, B.938019, B.938020. | |

Salvage number identification Table 401



CR 35716/00A LOCATION FIXTURE -CHAMBER WALL OUTER CHAMBER REAR FLANGE BOLT CLAMP SECTION AT FIXTURE Base

Holding Fixture Ref. Tool Item 1 Figure 402

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(2) Salvages identified in Table 402 may be used in any combination with Salvages in the range B935550-82.

| Salvage No. | As: | sy. Part No | o. | Replac | ed Parts |
|-------------------------|-----------|-------------|-----------|--------|----------|
| 3.935578 - 9 | B.936862, | B.936863, | B.936865, | (| B.497195 |
| | | | B.936885, | (| B.495732 |
| | B.936938, | B.938021, | B.938022, | | |
| | в.938173, | B.938178, | B.938179, | | |
| | в.938180, | B.938181, | B.938182, | | |
| | | B.938501, | | | |
| | B.938506, | B.938507, | B.938508, | | |
| | в.938509, | B.938510. | | | |

Salvage number identification Table 402

(3) Serviceable items may be re-used (Refer to paragraph 7).

3. Instructions

- A. Remove Shank Nuts and Vaporisers.
 - (1) Remove the vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.
 - (2) Remove the 32 vaporiser location pins, taking care not to damage the holes.
 - (3) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 35 and 18, Fig.401 and 414). Care must be taken not to damage the flange. Refer to 72-09-00, Repair, for removal procedure.
 - (4) Inspect for satisfactory removal of shank nuts.



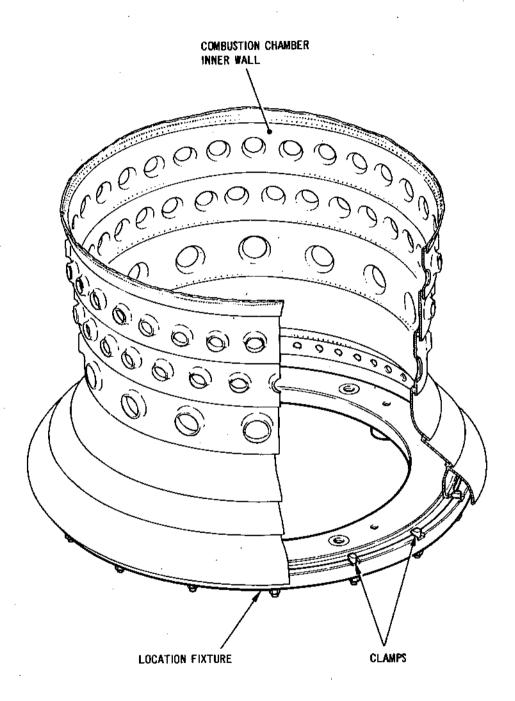
- B. Mark-off and Identify.
 - (1) Locate the chamber on its flanged end on a surface table and using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark three lines as follows:
 - (a) Circumferentially around the No.3 inner cooling ring (Ref. dash item 28. Fig.401), 0.20 in. (5,08 mm) above the weld line between the No.3 inner cooling ring and its lower adjacent section (Ref. dash items 28 and 27, Fig.401).
 - (b) Circumferentially around the inner front chamber section (Ref. dash item 29, Fig. 401), 0.20 in. (5,08 mm) below the weld line between the inner front chamber section and the No.2 inner cooling ring (Ref. dash items 29 and 30, Fig. 401).
 - (c) Circumferentially around the inner front chamber section (Ref. dash item 29, Fig. 401), running through the centreline of the plunged holes.
 - (2) Identify the outer chamber/head assy and inner chamber as a pair before cutting.



C. Cut Chamber.

- (1) Locate the chamber in holding fixture ref. tool item 1 (Ref.Fig.402), using packing to support the inner chamber. Separate the chamber by cutting circumferentially around the line marked at para.3.B. (1), (c), using an argon torch and anti-spatter guard, ref. tool item 2, or a mechanical cutter.
- (2) Remove sections from fixture.
- (3) Relocate outer chamber/head assy. to fixture ref. tool item 1 (Ref. Fig. 402) and using anti-spatter guard ref. tool item 2 and argon torch or mechanical cutter, cut back to line marked at para.3.8.(1), (b).
- (4) Remove outer chamber/head assy. from fixture.
- (5) Locate inner chamber to fixture ref. tool item 3 (Ref. Fig. 403) and using argon torch or mechanical cutter, cut back to line marked at para.3.8.(1), (a).
- (6) Remove inner chamber from fixture.
- (7) Clean to remove spatter bead, produced by plasma cutting, from outer chamber/head assy. and inner chamber. Care must be taken to ensure no thinning of parent metal occurs.
- (8) Inspect outer chamber/head assy. and inner chamber for excessive distortion.
- (9) Remove distortion if necessary using conventional hand tools.
- (10) Inspect for satisfactory separation of sections.
- D. Machine Outer Chamber/Head Assy.
 - (1) Locate the outer chamber/head assy. on a surface table locating on the rear outer flange. Using a suitable marking medium i.e. a black Magic Marker or Spectra Blue, mark off the 20.385 in. (517,78 mm) height as shown at Fig.404.

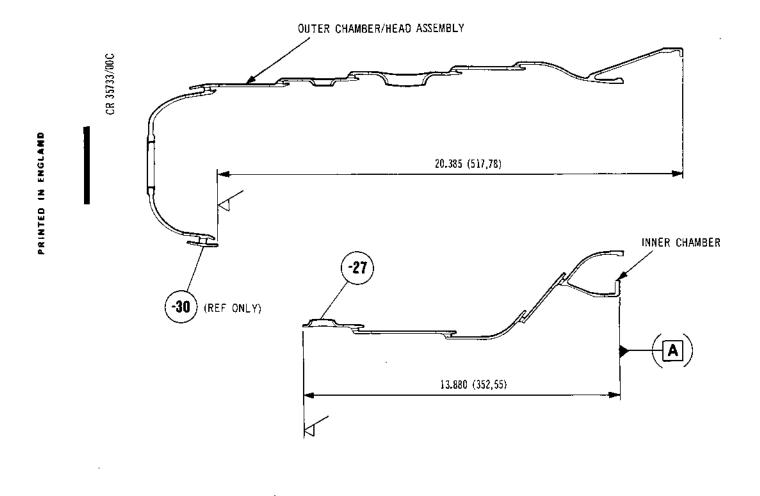
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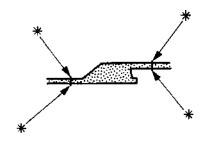


Holding Fixture Ref. Tool Item 3 Figure 403

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★ MAX WELD PROTRUSION 0.025 (0.63)

TYPICAL WELDS AT ALL COOLING RINGS

Machining Details Figure 404

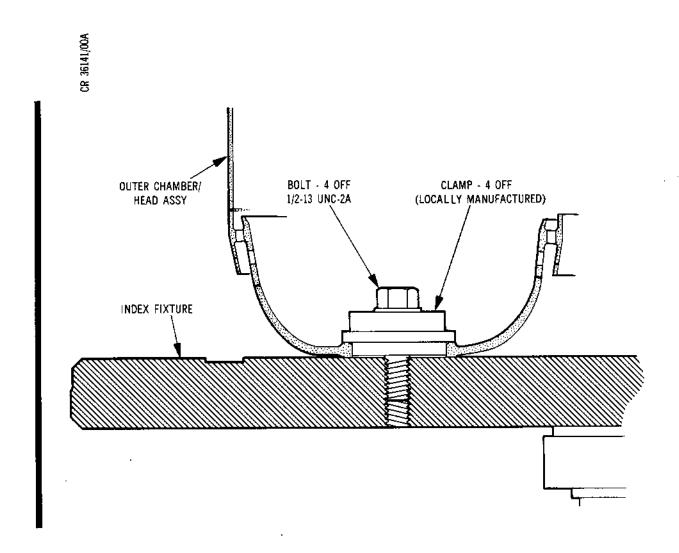
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

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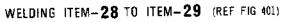


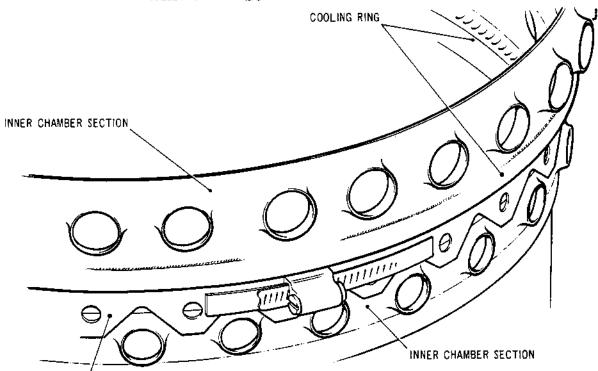
- (2) Remove the clamp bolt, clamp and spacer at four locations on fixture ref. tool item 23 and store in a container.
- (3) Locate outer chamber/head assy. to fixture, ref. tool item 23, (Ref. Fig. 405), and locate fixture/component assy. to a vertical centre lathe. Turn to produce the 20.385 in. (517,78 mm) height marked at para.(1). Remove burrs.
- (4) Inspect to ensure 20.385 in. (517,78 mm) dimension has been achieved satisfactorily.
- (5) Crack test the outer chamber/head assy. using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- E. Machine Inner Chamber.
 - (1) Locate the inner chamber on a surface table on the datum A flange (Ref. Fig. 404). Using a suitable marking medium i.e. a black Magic Marker or Spectra Blue, mark off the 13.880 in. (352,55 mm) height shown at Fig. 404.
 - (2) Locate inner chamber to fixture, ref. tool item 3 (Ref. Fig. 403), and locate fixture/component assyto a vertical centre lathe. Turn to produce the 13.880 in. (352,55 mm) height marked at para.(1). Remove burrs.
 - (3) Inspect to ensure 13.880 in. (352,55 mm) dimension has been achieved satisfactorily.
 - (4) Crack test the inner chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- F. Produce No.3 Inner Cooling Ring/Inner Front Chamber Section Assy.
 - (1) Withdraw from stores replacement inner front chamber section B_{*}495732 PDA and No_{*}3 inner cooling ring B_{*}497195_{*}

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Index Fixture Ref. Tool Item 23 Figure 405





RETAINING STRAP

WELDING ITEMS-28/-29 ASSY TO INNER CHAMBER (REF FIG 401)

Retaining Strap Ref. Tool Item 7
Figure 406

REPAIR

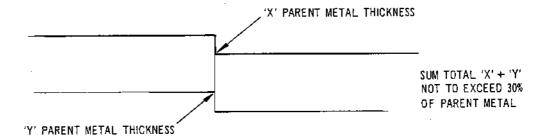
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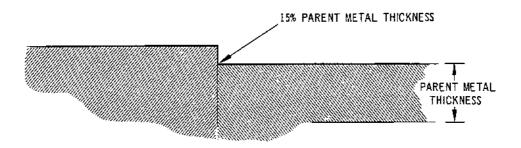
- (2) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
- (3) Assemble the replacement inner front chamber section (ref. dash item 29, Fig. 401) to the replacement No.3 inner cooling ring (ref. dash item 28, Fig. 401), using retaining strap Ref. tool item 7 (Ref. Fig. 406). The edge closest to the plunged holes is the abutment face on the inner front chamber section. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown at Fig. 407.
- (4) Tackweld, diametrically opposite, the replacement inner front chamber section to the replacement No.3 inner cooling ring, using argon backing stand, ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6., Process A, for welding data.
- (5) Remove retaining strap from inner front chamber section/No.3 inner cooling ring assy.
- (6) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy, if this is not possible, then the tackwelds must be broken to remove the replacement inner front chamber section from the No.3 inner cooling ring, then after dressing and cleaning, the tackwelding procedure repeated.
- (7) Clamp the inner front chamber section/No.3 inner cooling ring assy. to a welding table and autoweld the inner front chamber section to the No.3 inner cooling ring, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9, (Ref. Fig.408); refer to para.6, Process A, for welding data.
- (8) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig.404. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run.

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DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS



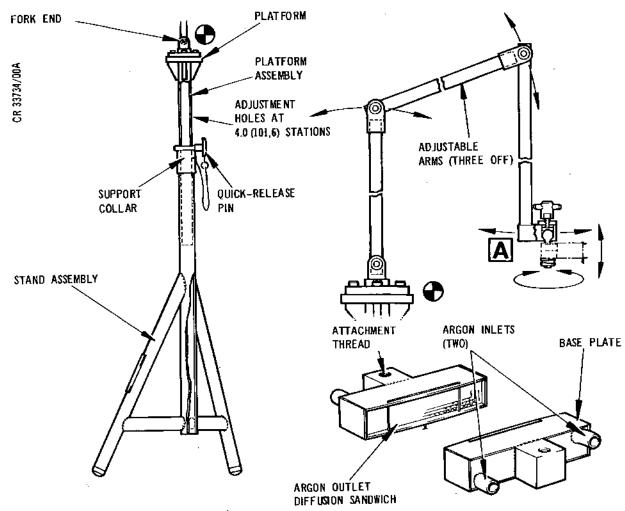
STEP CONDITION WHEN DNLY ONE SIDE CAN BE INSPECTED

Acceptable Mismatch Figure 407

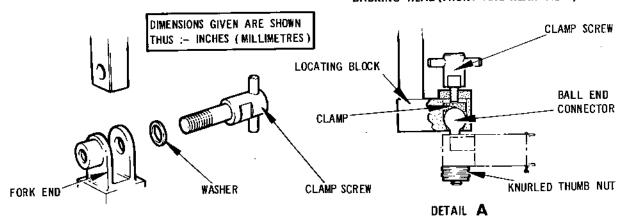
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TN55475





BACKING HEAD (FRONT AND REAR VIEW)



TYPICAL FORK END DETAIL

SHOWING BACKING HEAD ATTACHMENT

Argon Backing Stand and Head Ref. Tool Items 8 and 9 Figure 408

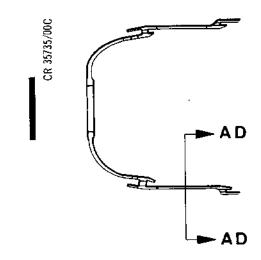
REPAIR

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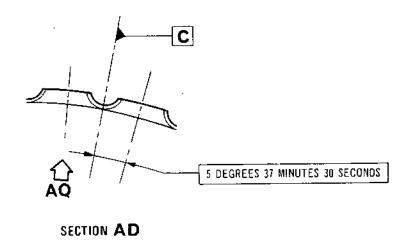


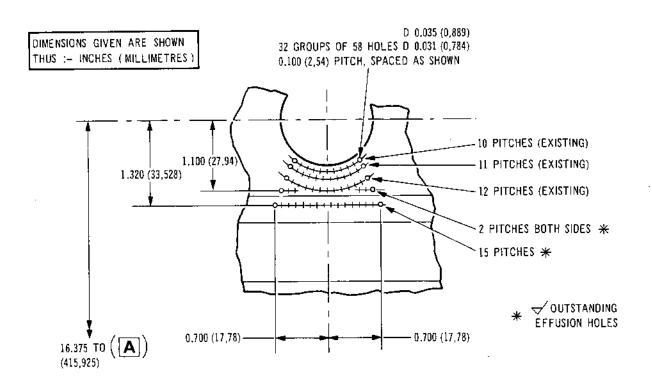
- (9) Inspect to ensure satisfactory welding.
- (1D) Crack test the inner front chamber section/No.3 inner cooling ring assy. using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- G. Produce Effusion Holes.
 - (1) Lightly mark ('pip') the surface of the inner front chamber section, indicating the position of the 22 outstanding effusion holes at 32 plunged hole positions, (Ref. Fig. 409), using a standard B.S. Number 1 centre drill and drill jigs, ref. tool items 10 and 11 (Ref. Fig.410). The jigs are used separately but in conjunction with each other as templates. Ensure correct alignment of drill jigs before 'pipping'.
 - (2) Remove drill jigs from inner front chamber section.
 - (3) Drill 32 groups of 22 outstanding effusion holes as shown at Fig.409, using a cobalt tipped drill.

 Ensure all holes are drilled at 90 degrees to chamber section surface.
 - (4) Remove any burrs from the effusion holes using a nonabrasive cutter.
 - (5) Inspect to ensure the correct number of effusion holes have been produced to the correct size and in the correct position.
 - (6) Crack test the inner front chamber section/No.3 inner cooling ring assy. using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.



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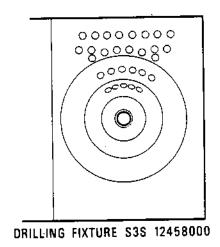


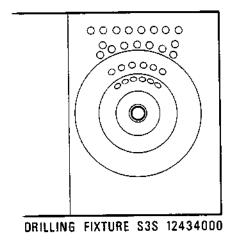
VIEW IN DIRECTION OF ARROW AQ (DEVELOPED)

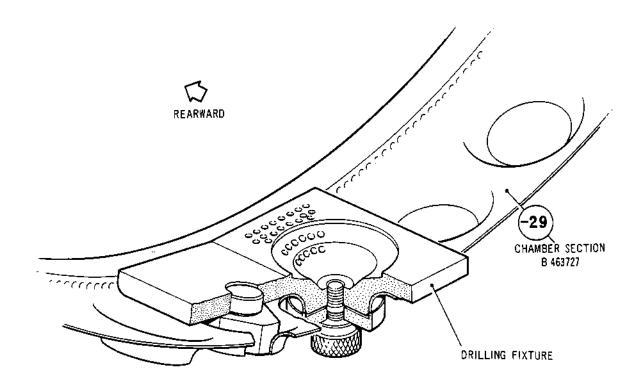
Effusion Holes Figure 409

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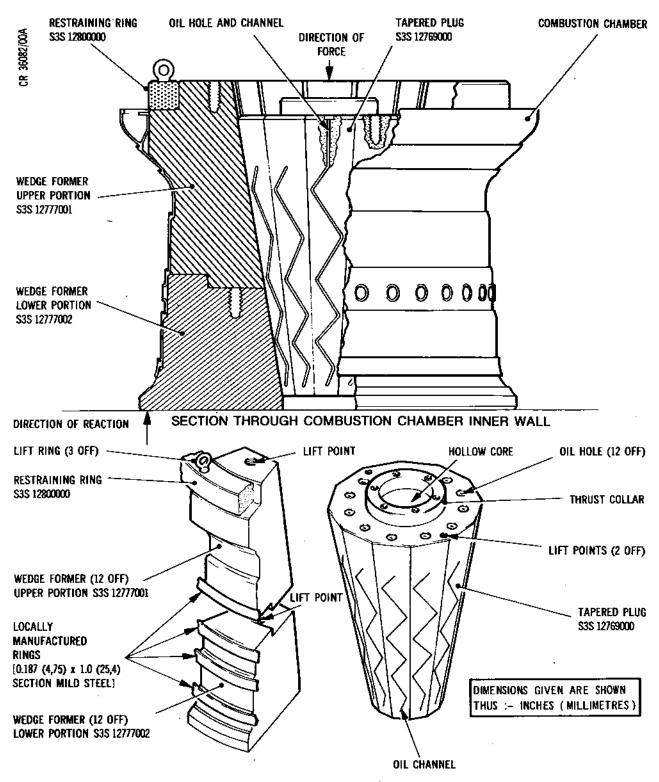




Drill Jigs Ref. Tool Items 10 and 11 Figure 410

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REPAIR



Expanding Equipment - Inner Chamber Figure 410A

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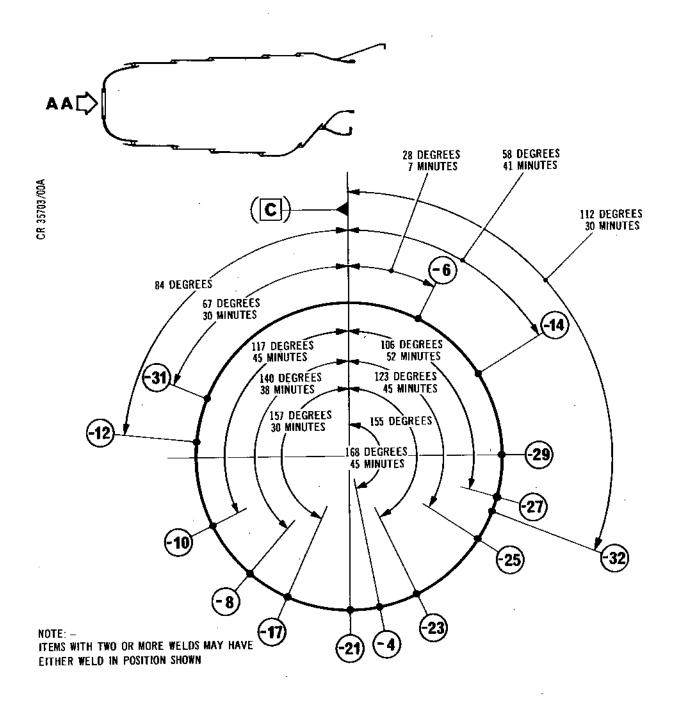
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- H. Weld Inner Front Chamber Section/No.3 Inner Cooling Ring Assy. to Inner Chamber.
 - NOTE: When replacing sections of the combustion chamber, it is usually necessary to expand existing sections to match the replaced parts, prior to welding. Expansion is carried out on a particular area adjacent to that being replaced. This is achieved by using segmented or split rings of local manufacture. (Use tools ref. items 19,20,21,22, Para.4 and Figure 410A).
 - (1) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (2) Assemble the inner front chamber section/No.3 cooling ring assy. to the inner chamber using retaining strap ref. tool item 7 (Ref. Fig.406), ensuring the longitudinal welds are in correct angular position as shown at Fig.411. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown at Fig.407.
 - (3) Tackweld, diametrically opposite, the inner front chamber section/No.3 cooling ring assy. to the inner chamber, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6, Process A, for welding data.
 - (4) Remove retaining strap from inner front chamber section/No.3 cooling ring assy./inner chamber assy.
 - (5) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the inner front chamber section/No.3 cooling ring assy. from the inner chamber, then after dressing and cleaning, the tackwelding procedure repeated.
 - (6) Clamp the inner front chamber section/No.3 cooling ring assy./inner chamber assy. to a welding table and autoweld, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6, Process A, for welding data.





DIAGRAMMATIC VIEW IN DIRECTION OF ARROW AA SHOWING ANGULAR POSITIONS OF LONGITUDINAL WELDS IN THE ABOVE ITEMS

Angular Relationship of Welds Figure 411

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- (7) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig.404. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, then the inner front chamber section/ No.3 cooling ring assy. must be removed by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (8) Inspect to ensure welding has been carried out satisfactorily.
- (9) Crack test the inner chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- J. Plasma Spray.
 - (1) Plasma spray the No.3 inner cooling ring and adjacent section (Ref. Fig. 401 items 28 and 29) as instructed in Chapter 72-41-01 Repair No.14.
- K. Machine Inner Chamber.
 - (1) Measure the 20.385 in. (517,78 mm) dimension (Ref. Fig.404) accurately, add 0.015 in. (0,38 mm) weld allowance and record total.
 - (2) Subtract from the dimension recorded at para.(1) the 2.680 in. (68,07 mm) dimension from the inside face of the rear outer flange to outside face of the rear inner flange (Ref. Fig. 401) and record.
 - (3) Subtract from the dimension recorded at para.(2) the 0.1025 in. (2,60 mm) rear outer flange thickness dimension (Ref. Fig. 401) and record.



FIGURE 412 CANCELLED

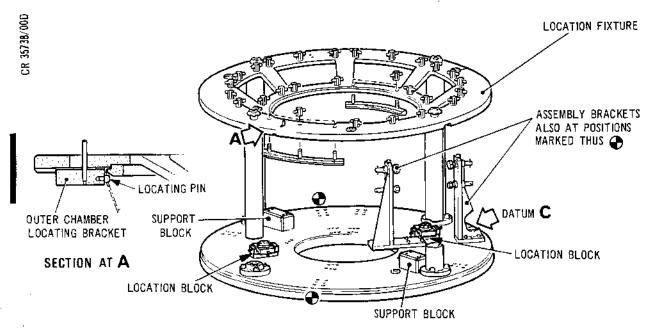
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- (4) Locate inner chamber to fixture ref. tool item 3 (Ref. Fig. 403), and locate chamber/fixture assy. to a vertical centre lathe. Set true.
- (5) Machine the inner chamber to an overall height as recorded at para.(3) from the datum A flange face (Ref. Fig. 401). Remove burrs.
- (6) Inspect for satisfactory machining.
- (7) Crack test the inner chamber, using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- L. Attach Inner Chamber to Outer Chamber/Head Assy.
 - (1) Remove the existing vaporiser seating pads from fixture ref. tool item 13 (Ref. Fig.413), and store in container ref. tool item 14. Attach items in adapter set ref. tool item 24 (Ref. Fig.413) to fixture.
 - (2) Polish the mating surface using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (3) Assemble the inner chamber to the outer chamber/head assy. using welding fixture ref. tool item 13 with adapter set ref. tool item 24 fitted (Ref. Fig.413). Ensure the longitudinal welds are in the correct position as shown at Fig.411. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown at Fig.407.

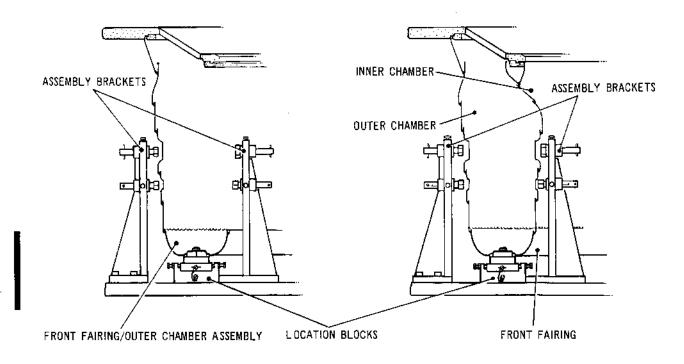
The inner chamber must be located in the NOTE: fixture using the four dowel holes shown at Section BA (Ref. Fig. 414). The outer chamber/head assy. is located in the fixture using the fixture locating pin (Ref. section A, Fig.413), engaged in the 0.900 in. (22,860 mm) diameter hole (Ref. Fig.415). It may be necessary to shim under the vaporiser location positions and wedge up the inner head assembly to overcome any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 in. (0,762 mm) at any one position and care must be taken not to damage the head assy. outer skin.

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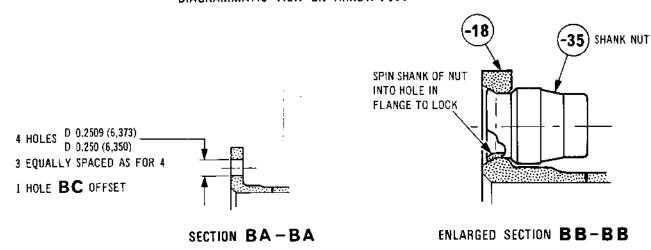
NOTE: ALTHOUGH THE ASSEMBLY BRACKETS ARE
USED TO ACHIEVE THE CORRECT ANGULAR
RELATIONSHIP OF THE INDIVIDUAL PARTS
THEY MUST BE USED IN CONNECTION WITH
THE STAGGERED WELD DIAGRAM (REF FIG 411)



Welding Fixture Ref. Tool Item 13 and Adapter Set Ref. Tool Item 24 Figure 413

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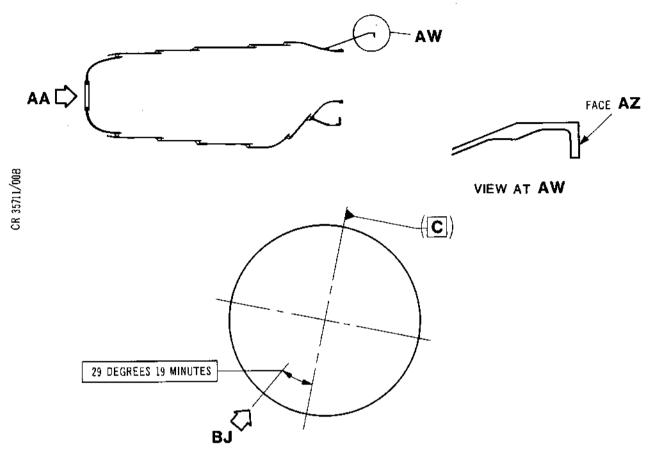
DIAGRAMMATIC VIEW ON ARROW A X



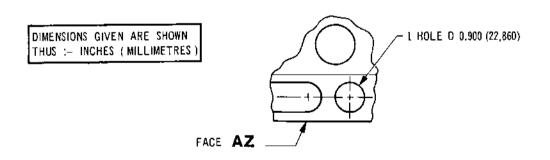
Dowel Hole Details Figure 414

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DIAGRAMMATIC VIEW IN DIRECTION OF ARROW AA



VIEW IN DIRECTION OF ARROW BJ

Hole Details Figure 415

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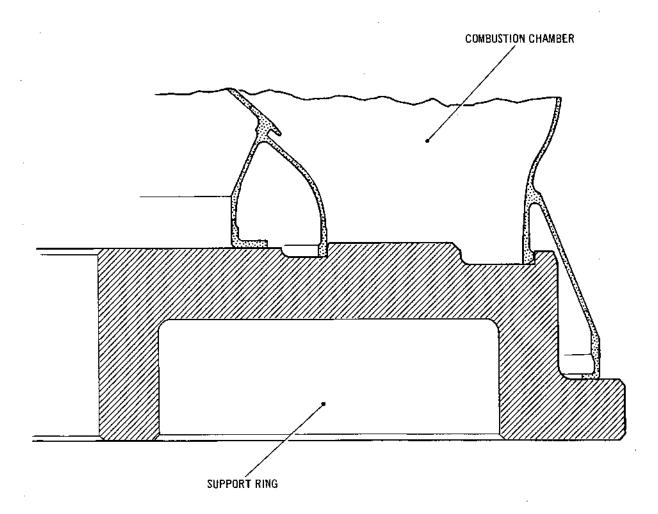
- (4) Tackweld, diametrically opposite, the inner chamber to the outer chamber/head assy. using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6, Process A for welding data.
- (5) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the inner chamber from the outer chamber/head assy. and after dressing and cleaning, the tackwelding procedure repeated.
- (6) Remove the combustion chamber assy. from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408), autoweld the inner chamber to the outer chamber/head assy.
- (7) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig. 404. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the inner chamber must be removed from the outer chamber/head assy. by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (8) Inspect to ensure the 2.710/2.650 in. (68,33/67,82 mm) and 20.620/20.520 in. (523,75/521,21 mm) dimensions (Ref.Fig.401) have been achieved, and that the welding has been carried out satisfactorily.
- (9) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

M. Heat Treat.

(1) Locate chamber to heat treatment support ring ref. tool item 16 (Ref. Fig. 416) and place component/ fixture assy. in a vacuum/argon furnace.

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Heat Treatment Support Ring Ref. Tool Item 16 Figure 416

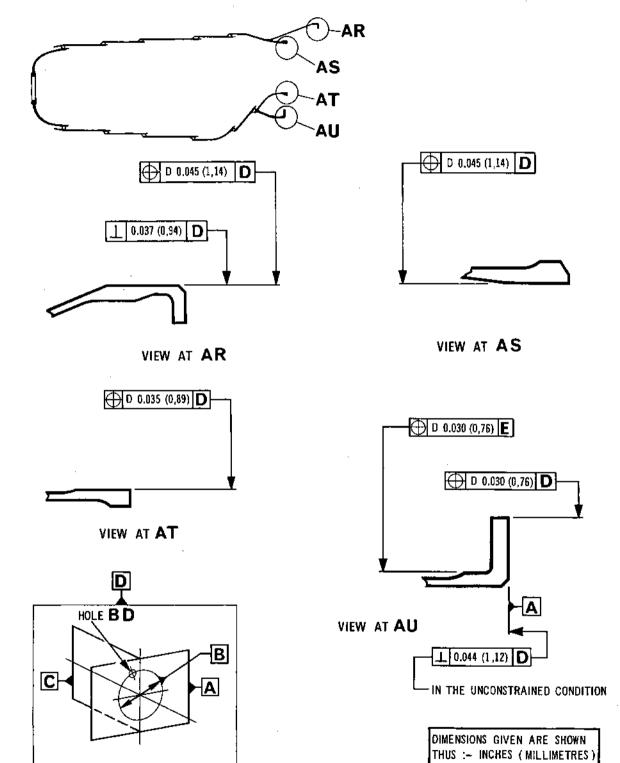
REPAIR

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- (2) Heat treat chamber to 800 deg.C. plus/minus 5 deg.C. for 8 hours. Rapid inert gas quench.
- (3) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- N. True-up Chamber.
 - (1) Generally true-up the chamber, using standard shop tools to achieve the tolerances shown at Fig. 417.
 - (2) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- P. Assemble Vaporisers.
 - (1) Shrink-fit 32 pins AS.20669 in position at the 16 vaporiser locations, ensuring that the pins are 0.005/0.000 in. (0,13/0,00 mm) below the fairing front face.
 - (2) Assemble the 16 vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.
- Q. Install Shank Nuts.
 - (1) Withdraw from stores 16 shank nuts AS.27871.
 - (2) Locate the shank nuts (Ref. dash item 35, Fig.401 and 414) progressively to rear flange (Ref. dash item 18, Fig.401), and swage over into countersunk holes, using swaging tool ref. tool item 17; refer to Chapter 72-09-00 Repair, for installation procedure.
 - (3) Inspect to ensure satisfactory installation of shank nuts.
- R. Inspect.
 - (1) Test the chamber for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

Dec 31/99



Tolerance Details Figure 417

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S. Identify.

- (1) Mark the combustion chamber with the following numbers, adjacent to the existing part number and using electro-chemical or vibro-percussion marking (Ref. 72-09-00 Repair):
 - (a) Salvage numbers SAL B497578-9 or SAL B935578-9 as appropriate (Ref. Tables 401 and 402).
 - (b) For combustion chambers listed in Table 403 only, line through the existing part number and mark the appropriate new part number.

| Existing Part No. | New Part No. |
|-------------------|--------------|
| B934944 | B935462 |
| B934945 | 8935463 |
| B936630 | B936627 |
| в936863 | B936862 |
| B936867 | B936865 |
| B936871 | B936869 |
| B936876 | В936873 |
| B936878 | В936875 |
| B936885 | B936884 |
| в938014 | B938013 |
| B938017 | B938015 |
| B938018 | 8938016 |
| B938022 | B938021 |
| B938179 | B938178 |
| B938181 | B938180 |
| | |

Table 403

T. Finally Inspect.

- (1) Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.
- (2) Generally clean the chamber to remove grease and foreign bodies, then place the chamber in container ref. tool item 18.



4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No . | <u>Item</u> | <u>Fig.No.</u> |
|---------------------|-----------|----------------|-------------|----------------|
| Holding Fixture | 1 | \$3\$.15231000 | 1 | 402 |
| Anti-spatter Guard | 1 | s3s.15919000 | 2 | - |
| Holding Fixture | 1 | s3s_12437000 | 3 | 403 |
| notating traces | Cancelled | | 4 | |
| | Cancelled | | 5 | |
| | Cancelled | | 6 | |
| Retaining Strap | 1 | S3S.15525000 | 7 | 406 |
| Argon Backing Stand | i | S3S.12445000 | 8 | 408 |
| Argon Backing Head | 1 | \$35.12446000 | 9 | 408 |
| Drill Jig | i | S3S.12434000 | 10 | 410 |
| Drill Jig | 1 | \$38.12458000 | 11 | 410 |
| Drice sig | Cancelled | 000112130000 | 12 | - |
| Welding Fixture | 1 | \$3\$.12431000 | 13 | 413 |
| Container | i | S3S.15936000 | 14 | - |
| Concainer | Cancelled | | 15 | |
| Support Ring | 1 | \$3\$.12439000 | 16 | 416 |
| Swaging Tool | i | S3S.12440000 | 17 | - |
| Container | i | S3S.11698000 | 18 | _ |
| Tapered Plug | 1 | \$3\$.12769000 | 19 | 410A |
| Wedge Former | 12 | \$3\$.12777001 | 20 | 410A |
| Wedge Former | 12 | \$3\$.12777002 | 21 | 41 O A |
| Restraining Ring | 1 | \$3\$.12800000 | 22 | 410A |
| - | 1 | s3s.15924000 | 23 | 405 |
| Index Fixture | 1 | \$35.15910000 | 24 | 405 |
| Adapter Set | I I | 333.13710000 | L 4 | 405 |

5. Replacement Parts

| <u>Description</u> | Quantity | Part No - | I.P.C. | Fig./Item |
|-----------------------------|----------|-------------|----------|-----------|
| No.3 Inner Cooling | 1 | B.497195 | 72-41-01 | |
| Ring Inner Front Chamber | 1 | B.495732PDA | 72-41-01 | |
| Section Shank Nuts | 16 | AS.27871 | 72-41-01 | |

6. <u>Welding Data</u>

A. Process A.

- (1) Method of Welding: Automatic circumferential argon arc butt.
- (2) Machine: Analog 300.

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- (3) Positioner: Aga.
- (4) Torch: Interlas 301 water-cooled.
- (5) Electrode: 0.125 in. (3,175 mm) thoriated tungsten.
- (6) Arc Length: 0.040 in. (1,02 mm).
- (7) Weld Speed: 7.0 in./min. (177,8 mm/min.).
- (8) Current: 70-74 amps.
- (9) Downslope Time:
 10 sec.
- (10) Torch Gas:
 22 cu.ft/hr.(11 litres/min.) Argon at 15 psi (103 kPa).
- (11) Shroud Gas:
 22 cu.ft/hr.(11 litres/min.) Argon at 15 psi (103 kPa).
- (12) Backing Gas: 88 cu.ft/hr.(44 litres/min.) Argon at 30 psi (206 kPa).

7. Serviceable Items

- A. When re-using serviceable items where the weld joint has been plasma sprayed, proceed as follows:
 - (1) Dry abrasive blast using aluminium oxide grit 18/24 mesh to remove the top two coats of magnesium zirconate for a distance of 0.250 in. (6,35 mm) from the joint. Refer to 72-09-24 Repair for procedure.
 - (2) Prepare the edge for welding using an aluminium oxide scurf mop.
 - (3) Autoweld the serviceable item as instructed in this Repair.



(4) Inspect visually.

NOTE: The unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burn or an aluminium oxide scurf mop.

(5) Crack test the welded items using the fluorescent dye penetrant process specified in this Repair.



COMBUSTION CHAMBER (ZBR) - REPAIR REPLACEMENT OF NO.3 OUTER COOLING RING AND ADJACENT OUTER FRONT CHAMBER SECTION

MODIFICATION NO. OL.8744C, OL.8851C

1. Effectivity

| I.P.C. | Fig./ | <u>Item</u> | Part No. | | | |
|----------|-------|-------------|--|--|--|--|
| 72-41-01 | 2 | | B.936627, B.936863, B.936869, B.936875, B.936885, B.938014, B.938017, B.938020, B.938173, B.938183, | B.934943, B.935462, B.936630, B.936865, B.936874, B.936876, B.936882, B.936938, B.938015, B.938015, B.938181, B.938178, B.938501, B.938507, | B.935463, B.936862, B.936867, B.936873, B.936878, B.936884, B.938013, B.938016, B.938019, B.938179, B.938182, B.938505, | |

2. Introduction

A. General

(1) This repair describes the procedure for replacing the combustion chamber No.3 outer cooling ring, and adjacent outer front chamber section to restore the chamber to a serviceable condition.

B.938509, B.938510.

- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.

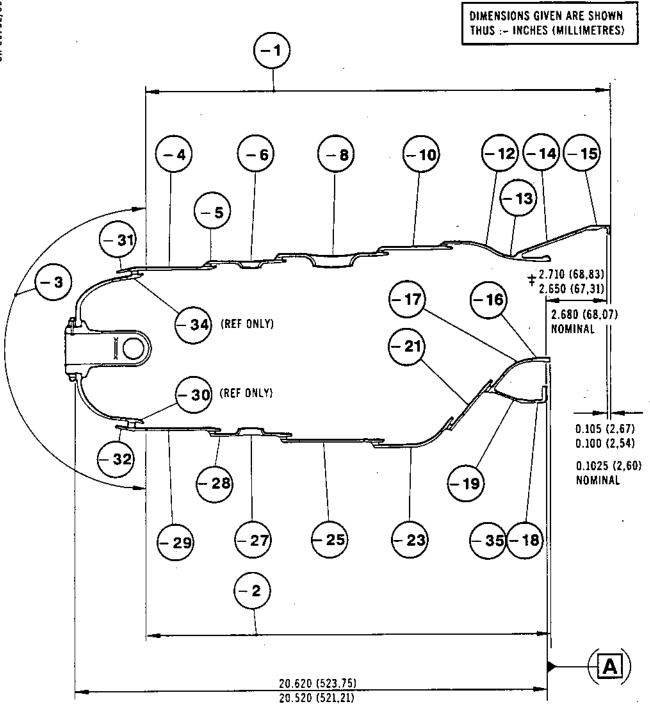
REPAIR

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OVERHAUL



CR 35732/00C



MEASURE FROM MEAN OF FLANGE SWASH MAXIMUM TOTAL SWASH 0.060 (1,52)

Combustion Chamber Details Figure 401

REPAIR

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- (7) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) After welding, ovality and shrinkage on items indicated Z (Ref.Fig.411) may be up to minus 0.240 in. (6,096 mm) on diameter.
- (10) The igniter hole positions (Ref.Fig.411) may be plus/minus 0.050 in. (1,27 mm) from the horizontal centre line of the combustion chamber after welding.
- (11) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.
- (12) All welds are classified as Group 2.
- B. Repair Limitations.
 - (1) Salvages identified in Table 401 may be used in any combination with Salvages in the range B497550-89.

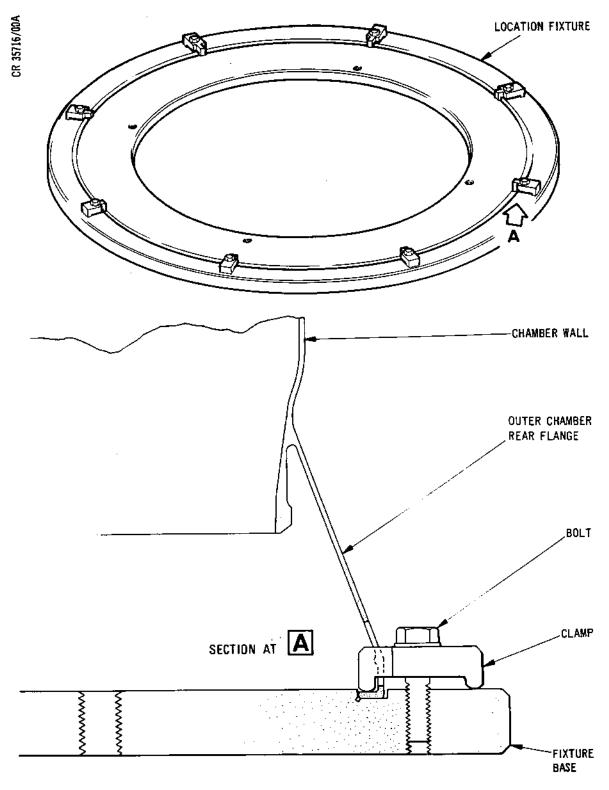
| Salvage No | O- As | ssy. Part No | Replaced Parts | |
|------------|-----------|----------------------------|----------------|------------|
| 3.497554-5 | - | в.934943, | • | (B.497193 |
| | - | , B.935462, , B.936630, | • | (в.495721 |
| | B.936871, | в.936873, | B.936875, | |
| | • | , в.936878, , в.938013, | • | |
| | B.938015 | . в.938016, | B.938017, | |
| | B.938018, | , B.938019, | B.938020. | |

Salvage number identification Table 401

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Holding Fixture Ref. Tool Item 1 Figure 402

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(2) Salvages identified in Table 402 may be used in any combination with Salvages in the range B935550-82.

| Salvage No. | | Assy. Part No. | | Replaced Parts | |
|-------------|--|--|--|----------------|--------------------|
| | B.936862, B. B.936867, B. B.936938, B. B.938173, B. B.938180, B. B.938183, B. B.938506, B. | .936884, .938021, .938178, .938181, .938501, | B.936885, B.938022, B.938179, B.938182, B.938505, B.938508, | | B497193 B495721 |

Salvage number identication Table 402

(3) Serviceable items may be re-used (Refer to paragraph 7).

Instructions

- A. Remove Shank Nuts and Vaporisers.
 - (1) Remove the vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.
 - (2) Remove the 32 vaporiser location pins, taking care not to damage the holes.
 - (3) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 35 and 18, Fig.401 and 414). Care must be taken not to damage the flange. Refer to 72-09-00, Repair, for removal procedure.
 - (4) Inspect to ensure satisfactory removal of shank nuts.



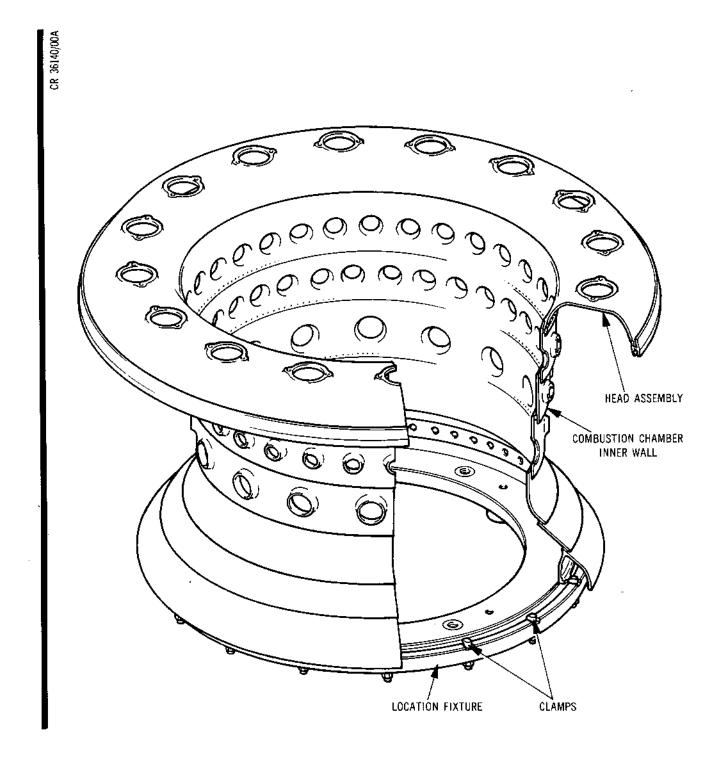
- B. Mark-off and Identify.
 - (1) Locate the chamber on its flanged end on a surface table and using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark three lines as follows:
 - (a) Circumferentially around the No.3 outer cooling ring (Ref. dash item 5. Fig.401), 0.20 in. (5,08 mm) above the weld line between the No.3 outer cooling ring and its lower adjacent section (Ref. dash items 5 and 6, Fig.401).
 - (b) Circumferentially around the outer front chamber section (Ref. dash item 4, Fig. 401), 0.20 in. (5,08 mm) below the weld line between the outer front chamber section and the No.2 outer cooling ring (Ref. dash items 4 and 34, Fig. 401).
 - (c) Circumferentially around the outer front chamber section (Ref. dash item 4, Fig. 401), running through the centreline of the plunged holes.
 - (2) Identify the inner chamber/head assy. and outer chamber as a pair before cutting.



C. Cut Chamber.

- (1) Locate the chamber in holding fixture ref. tool item 1 (Ref.Fig.402), using packing to support the inner chamber. Separate the chamber by plasma cutting circumferentially around the line marked at para.3.8. (1), (c), using an argon torch and anti-spatter guard, ref. tool item 2 or a mechanical cutter.
- (2) Remove sections from chamber.
- (3) Locate inner chamber/head assy. to fixture ref. tool item 3 (Ref. Fig. 403) and using anti-spatter guard ref. tool item 2 and argon torch or mechanical cutter, cut back to line marked at para.3.8.(1), (b).
- (4) Remove inner chamber/head assy. from fixture.
- (5) Locate outer chamber to fixture ref. tool item 1 (Ref. Fig.402) and using argon torch or mechanical cutter, cut back to line marked at para.3.8.(1), (a).
- (6) Remove outer chamber from fixture.
- (7) Clean to remove spatter bead, produced by plasma cutting, from inner chamber/head assy. and outer chamber. Care must be taken to ensure no thinning of parent metal occurs.
- (8) Inspect inner chamber/head assy. and outer chamber for excessive distortion.
- (9) Remove distortion if necessary using conventional hand tools.
- (10) Inspect for satisfactory separation of sections.
- D. Machine Inner Chamber/Head Assy.
 - (1) Locate the inner chamber/head assy. on a surface table locating on the datum A flange (Ref. Fig. 404). Using a suitable marking medium i.e. a black Magic Marker or Spectra Blue, mark off the 17.525 in. (445,14 mm) height as shown at Fig. 404.

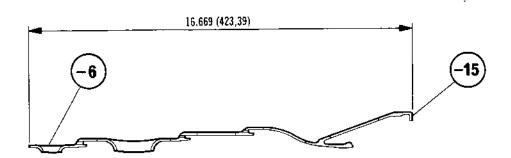




Holding Fixture Ref. Tool Item 3 Figure 403

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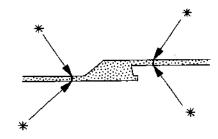
PRINTED IN ENGLAND



(REF ONLY)

-34 (REF ONLY)

-18



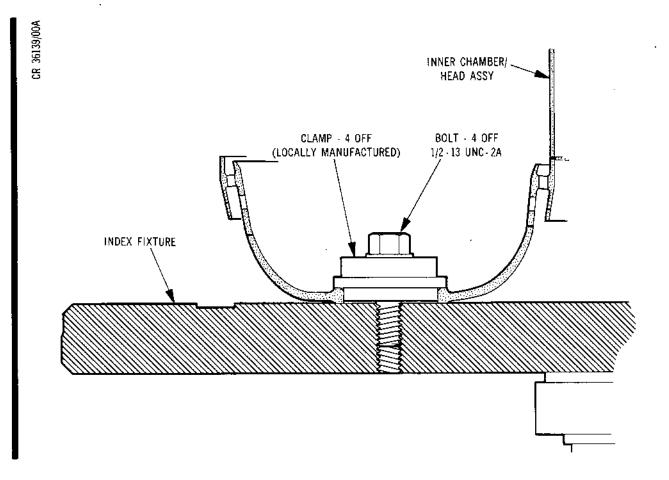
* MAX WELD PROTRUSION 0.025 (0,63)

TYPICAL SECTION THROUGH COOLING RING

Machining Details Figure 404

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- (2) Remove the clamp bolt, clamp and spacer at four locations on fixture ref. tool item 25 and store in a container.
- (3) Locate inner chamber/head assy. to fixture, ref. tool item 25, (Ref. Fig. 405), and locate fixture/component assy. to a vertical centre lathe. Turn to produce the 17.525 in. (445,14 mm) height marked at para.(1). Remove burrs.
- (4) Inspect to ensure the 17.525 in. (445,14 mm) dimension has been achieved satisfactorily.
- (5) Crack test the inner chamber/head assy. using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- E. Machine Outer Chamber.
 - (1) Locate the outer chamber on a surface table locating on the rear outer flange. Using a suitable marking medium i.e. a black Magic Marker or Spectra Blue, mark off the 16.669 in. (423,39 mm) height shown at Fig.404.
 - (2) Locate outer chamber to fixture, ref. tool item 1 (Ref. Fig. 402), and locate fixture/component assy. to a vertical centre lathe. Turn to produce the 16.669 in. (423,39 mm) height marked at para.(1). Remove burrs.
 - (3) Inspect to ensure the 16.669 in. (423,39 mm) dimension has been achieved satisfactorily.
 - (4) Crack test the outer chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- F. Produce No.3 Outer Cooling Ring/Outer Front Chamber Section Assy.
 - (1) Withdraw from stores replacement outer front chamber section B.495721 PDA and No.3 outer cooling ring B.497193.



Index Fixture Ref. Tool Item 25 Figure 405

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No3 OUTER COOLING RING

WELDING ITEM-4 TO ITEM-5 (REF FIG 401)

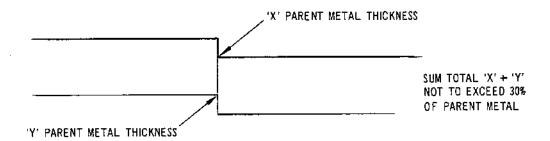
Retaining Strap Ref. Tool Item 7 Figure 406

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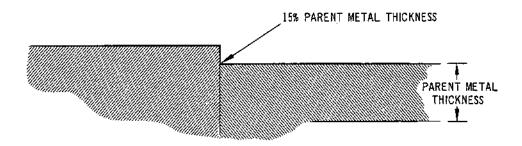


- (2) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
- (3) Assemble the replacement outer front chamber section (Ref. dash item 4, Fig. 401) to the replacement No.3 outer cooling ring (Ref. dash item 5, Fig. 401) using retaining strap ref. tool item 7 (Ref. Fig. 406). The edge closest to the plunged holes is the abutment face on the outer front chamber section. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown at Fig. 407.
- (4) Tackweld, diametrically opposite, the replacement outer front chamber section to the replacement No.3 outer cooling ring, using argon backing stand, ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6., Process A, for welding data.
- (5) Remove retaining strap from outer front chamber section/No.3 outer cooling ring assy.
- (6) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy, if this is not possible, then the tackwelds must be broken to remove the replacement outer front chamber section from the No.3 outer cooling ring, then after dressing and cleaning, the tackwelding procedure repeated.
- (7) Clamp the outer front chamber section/No.3 outer cooling ring assy. to a welding table and autoweld the outer front chamber section to the No.3 outer cooling ring, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9, (Ref. Fig. 408); refer to para.6, Process A, for welding data.
- (8) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig. 404. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run.

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DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS

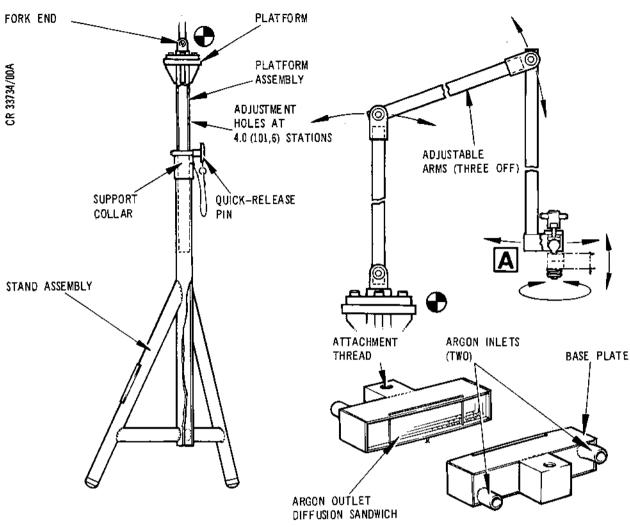


STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

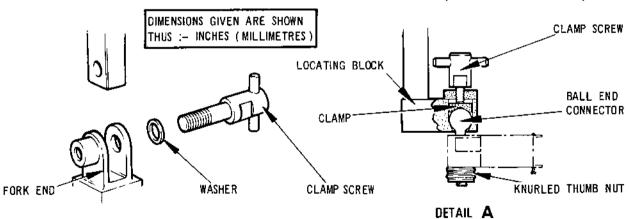
Acceptable Mismatch Figure 407 5508

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BACKING HEAD (FRONT AND REAR VIEW)



TYPICAL FORK END DETAIL

SHOWING BACKING HEAD ATTACHMENT

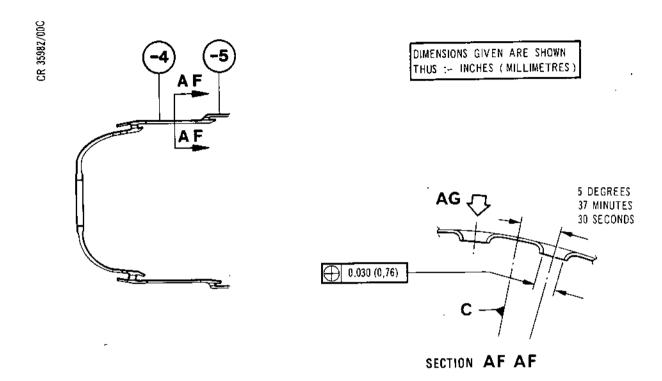
Argon Backing Stand Ref. Tool Item 8 and Argon Backing Head Ref. Tool Item 9 Figure 408

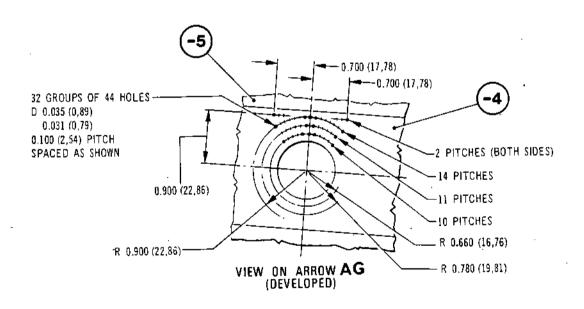
REPAIR

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- (9) Inspect to ensure satisfactory welding.
- (10) Crack test the outer front chamber section/No.3 outer cooling ring assy. using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- FA. Produce Outer Replacement Section Effusion Holes.
 - (1) Lightly mark ('pip') the surface of the outer section at the positions of the 32 groups of 44 effusion holes as shown at Fig. 408A, with a standard B.S. Number 1 centre drill, using drill jigs ref. tools items 19 and 20; tools to be used separately but in conjunction with each other as templates (Ref. Fig. 408B). Ensure correct alignment of drill jigs before 'pipping'.
 - (2) Remove the drill jigs from the replacement outer section/replacement outer cooling ring assembly.
 - (3) Drill 32 groups of 44 effusion holes as shown at Fig. 408A, using a cobalt tipped drill. Ensure all holes are drilled at 90 degrees to the surface.
 - (4) Remove the burrs from the holes produced at para.(3), using a non-abrasive cutter.
 - CAUTION: NO THINNING OF PARENT METAL OR GRINDING PERMITTED.
 - (5) Check that the correct number of effusion holes have been produced to the correct size and position (Ref.Fig.408A).



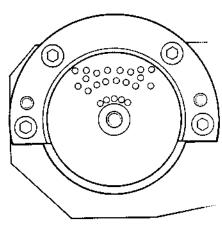


Outer Section Effusion Holes Figure 408A

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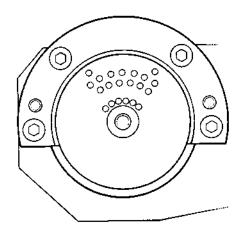
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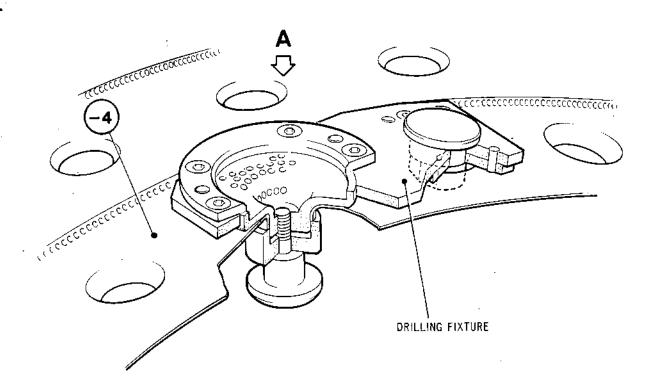
DRILLING FIXTURE \$3\$ 12433000 VIEW IN DIRECTION OF ARROW A







DRILLING FIXTURE S3S 12457000 VIEW IN DIRECTION OF ARROW A



Drilling Fixtures Figure 408B

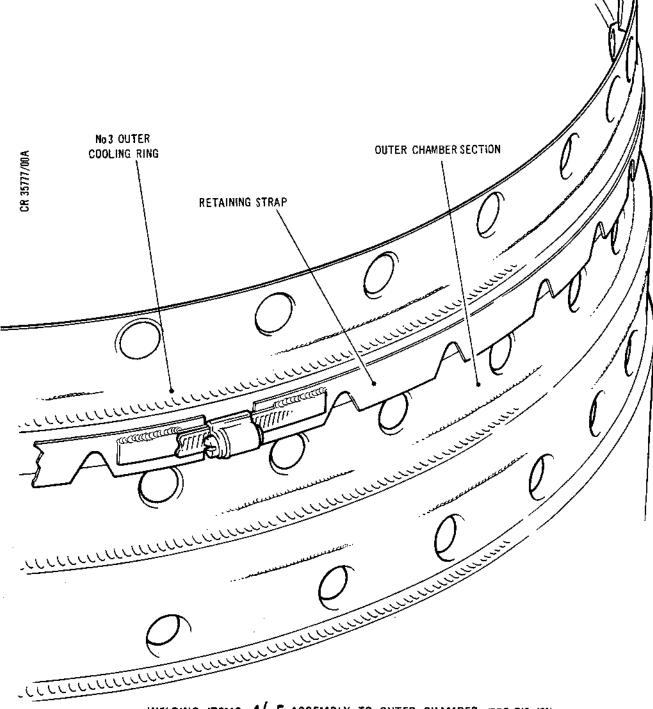
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- G. Weld Outer Front Chamber Section/No.3 Outer Cooling Ring Assy. to Outer Chamber.
 - (1) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (2) Assemble the outer front chamber section/No.3 outer cooling ring assy. to the outer chamber using retaining strap ref. tool item 10 (Ref. Fig.409), ensuring the longitudinal welds are in correct angular position as shown at Fig.410. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown at Fig.407.
 - (3) Tackweld, diametrically opposite, the outer front chamber section/No.3 outer cooling ring assy. to the outer chamber, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6, Process A, for welding data.
 - (4) Remove retaining strap from outer front chamber section/No.3 outer cooling ring assy./outer chamber assy.
 - (5) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the outer front chamber section/No.3 cooling ring assyfrom the outer chamber, then after dressing and cleaning, the tackwelding procedure repeated.
 - (6) Clamp the outer front chamber section/No.3 cooling ring assy./outer chamber assy. to a welding table and autoweld, using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6, Process A, for welding data.

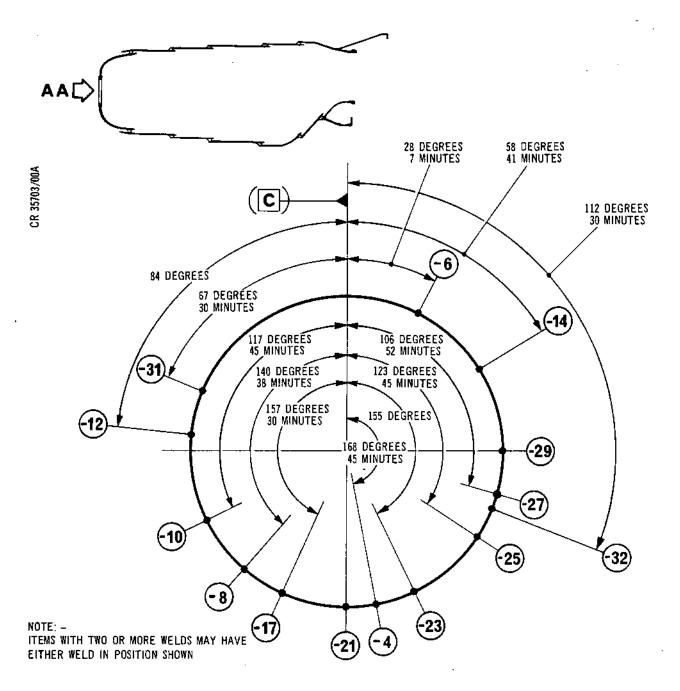


WELDING ITEMS-4/-5 ASSEMBLY TO OUTER CHAMBER (REF FIG 401)

Retaining Strap Ref. Tool Item 10 Figure 409

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DIAGRAMMATIC VIEW IN DIRECTION OF ARROW A A SHOWING ANGULAR POSITIONS OF LONGITUDINAL WELDS IN THE ABOVE ITEMS

Angular Relationship of Longitudinal Welds Figure 410

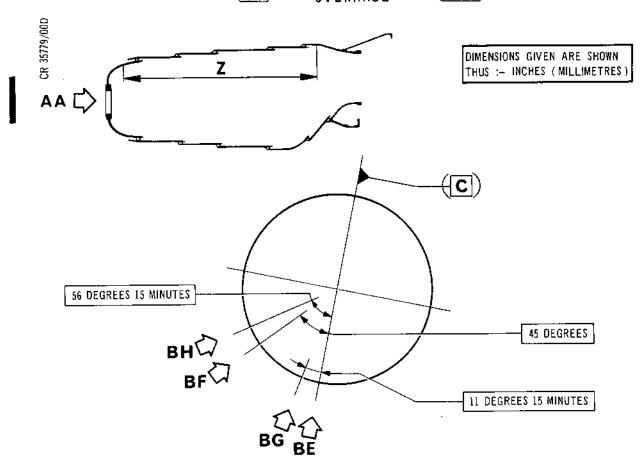
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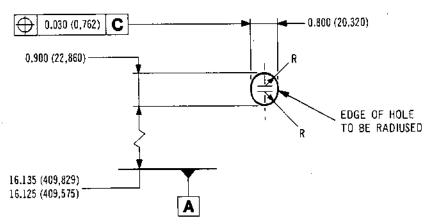
- (7) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig. 404. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, then the outer front chamber section/No.3 cooling ring assy. must be removed by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (8) Inspect to ensure welding has been carried out satisfactorily.
- (9) Crack test the outer chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- H. Produce Masking Plate Location Holes.
 - (1) Locate the outer chamber on its flanged end on a surface table and using a suitable marking medium i.e. a black Magic Marker or Spectra Blue mark the position of the 4 igniter holes shown at Fig.411.
 - (2) Check to ensure the igniter hole positions have been marked satisfactorily.
 - (3) Locate the outer chamber in fixture ref. tool item 3 (Ref. Fig. 403), and locate the fixture/component assy. to drilling machine.
 - (4) Drill to produce 4 masking plate location holes 0.250 in. (6,35 mm) diameter, in the position of the 4 igniter holes as marked at para.(1).
 - (5) Remove burrs.
 - (6) Check to ensure the masking plate location holes have been produced satisfactorily.
 - (7) Crack test the outer chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

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DIAGRAMMATIC VIEW ON ARROW AA



VIEW ON ARROW BE BF, BG AND BH SIMILAR

Igniter Hole Details Figure 411

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FIGURE 412 CANCELLED

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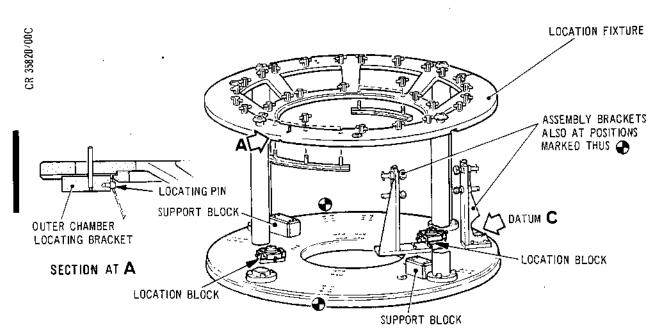
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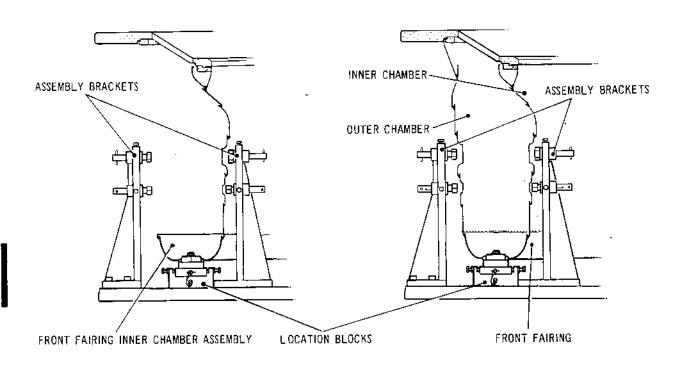
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- J. Plasma Spray.
 - (1) Plasma spray the No.3 outer cooling ring and adjacent section (Ref. Fig. 401 items 4 and 5) as instructed in Chapter 72-41-01 Repair No.14.
- K. Machine Outer Chamber.
 - (1) Measure the 17.525 in. (445,14 mm) dimension (Ref. Fig.404) accurately, add 0.015 in. (0,38 mm) weld allowance and record total.
 - (2) Add to the dimension recorded at para.(1) the 2.680 in. (68,07 mm) dimension from the inside face of the rear outer flange to outside face of the rear inner flange (Ref. Fig.401) and record.

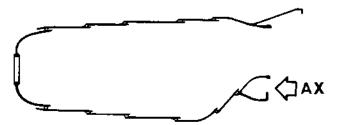


NOTE: ALTHOUGH THE ASSEMBLY BRACKETS ARE USED TO ACHIEVE THE CORRECT ANGULAR RELATIONSHIP OF THE INDIVIDUAL PARTS THEY MUST BE USED IN CONNECTION WITH THE STAGGERED WELD DIAGRAM (REF FIG 410)

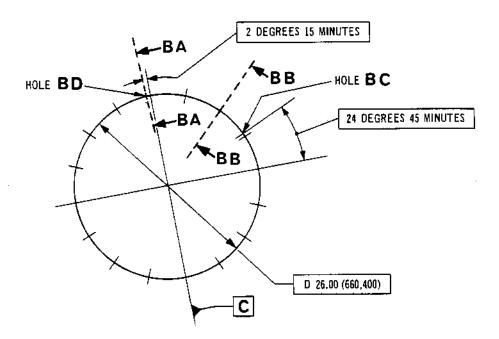


Welding Fixture Ref. Tool Item 13 and Adapter Set Ref. Tool Item 26 Figure 413

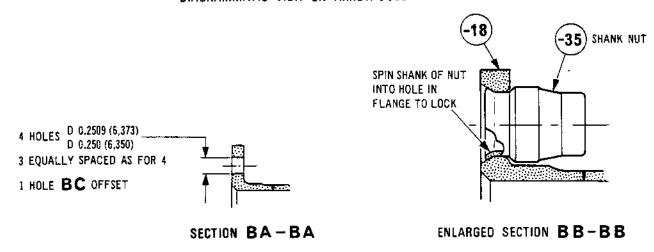
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DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



DIAGRAMMATIC VIEW ON ARROW AX

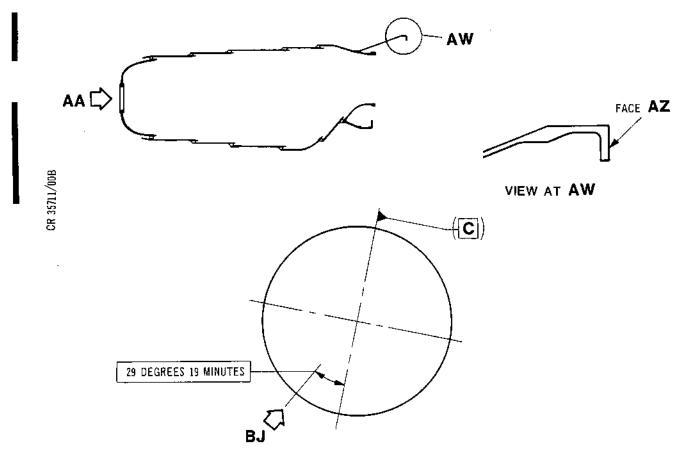


Dowel Hole and Shank Nut Details Figure 414

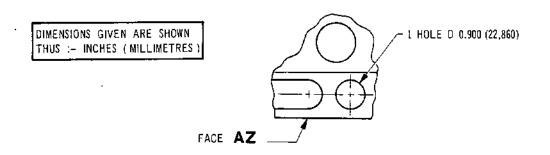
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- (3) Add to the dimension recorded at para.(2) the 0.1025 in. (2,60 mm) rear outer flange thickness dimension (Ref. Fig. 401) and record.
- (4) Locate outer chamber to fixture ref. tool item 1 (Ref. Fig.402), and locate chamber/fixture assy. to a vertical centre lathe. Set true.
- (5) Machine the outer chamber to an overall height as recorded at para.(3) from the rear outer flange. Remove burrs.
- (6) Inspect for satisfactory machining.
- (7) Crack test the inner chamber, using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- L. Attach Outer Chamber to Inner Chamber/Head Assy.
 - (1) Remove the existing vaporiser seating pads from fixture ref. tool item 13 (Ref. Fig.413), and store in container ref. tool item 14. Attach items in adapter set ref. tool item 26 (Ref. Fig.414) to fixture.
 - NOTE: When replacing sections of the combustion chamber, it is usually necessary to expand existing sections to match the replaced part, prior to welding. Expansion is carried out on the particular area, adjacent to that being replaced. This is achieved by using segmented or split rings of local manufacture. (Use tools ref items 21, 22, 23, 24, Para.4 and Figure 415A).
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (3) Assemble the outer chamber to the inner chamber/head assy_ using welding fixture ref. tool item 13 with adapter set ref. tool item 26 fitted (Ref. Fig.413). Ensure the longitudinal welds are in the correct position as shown at Fig.410. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown at Fig.407.





DIAGRAMMATIC VIEW IN DIRECTION OF ARROW AA

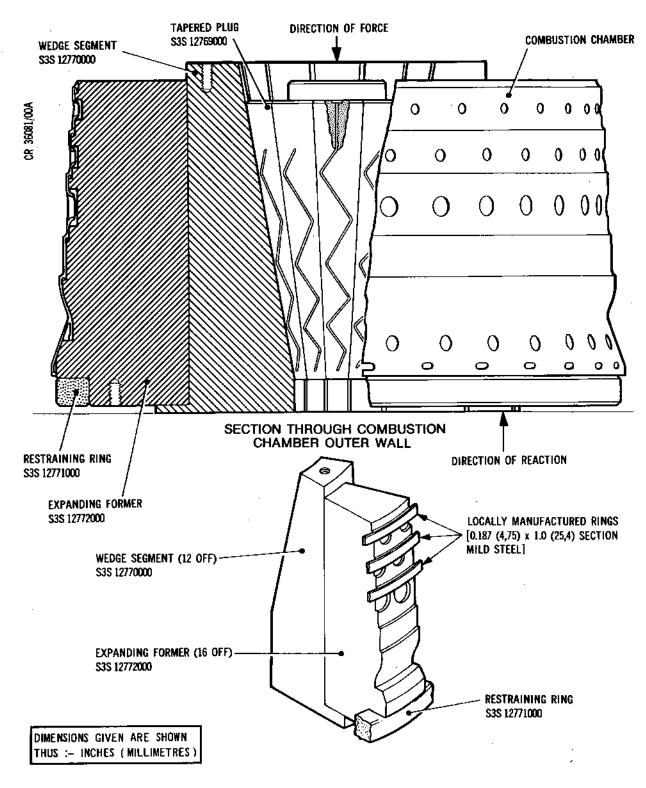


VIEW IN DIRECTION OF ARROW BJ

Hole Details Figure 415

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Expanding Equipment - Outer Chamber Figure 415A

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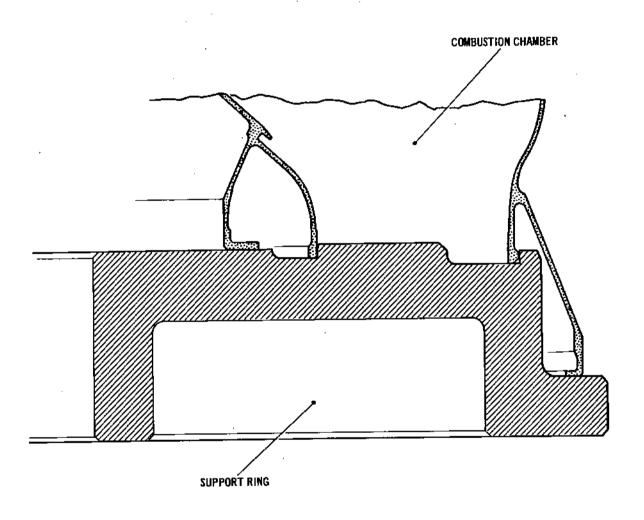
72-41-01 Repair No.10 Page 424B Dec 1/86 NOTE: The inner chamber/head assembly must be located in the fixture using the four dowel holes shown at Section BA (Ref. Fig.414). The outer chamber is located in the fixture using the fixture locating pin (Ref. section A, Fig.413), engaged in the 0.900 in. (22,860 mm) diameter hole (Ref. Fig.415).

It may be necessary to shim under the vaporiser location positions and wedge up the outer head assembly to overcome any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 in. (0,762 mm) at any one position and care must be taken not to damage the head assy. outer skin.

- (4) Tackweld, diametrically opposite, the outer chamber to the inner chamber/head assy. using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408); refer to para.6, Process A for welding data.
- (5) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the outer chamber from the inner chamber/head assy. and after dressing and cleaning, the tackwelding procedure repeated.
- (6) Remove the combustion chamber assy. from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 8 and argon backing head ref. tool item 9 (Ref. Fig. 408), autoweld the outer chamber to the inner chamber/head assy.
- (7) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig.404. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the outer chamber must be removed from the inner chamber/head assy. by plasma cutting and machining as detailed previously, and the whole procedure repeated.

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Heat Treatment Support Ring Ref. Tool Item 16
Figure 416

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- (8) Inspect to ensure the 2.710/2.650 in. (68,33/67,82 mm) dimension (Ref.Fig.401) has been achieved and that the welding has been carried out satisfactorily.
- (9) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

M. Heat Treat.

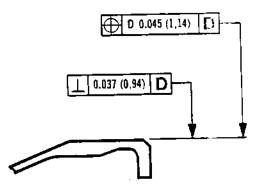
- (1) Locate chamber to heat treatment support ring ref. tool item 16 (Ref. Fig.416) and place component/ fixture assy. in a vacuum/argon furnace.
- (2) Heat treat chamber to 800 deg.C. plus/minus 5 deg.C. for 8 hours. Rapid inert gas quench.
- (3) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- N. Produce Igniter Holes.
 - (1) Locate chamber to fixture ref. tool item 1 (Ref. Fig. 402), and locate component/fixture assyto a jig boring machine.
 - (2) Produce the 4 igniter holes shown at Fig.411 in the position of the 0.250 in. (6,35 mm) masking plate location holes produced at para.H.(4).
 - (3) Remove burrs and radius edge of each igniter hole.
- P. True-up Chamber.
 - (1) Generally true-up the chamber, using standard shop tools to achieve the tolerances shown at Fig.417.
 - (2) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- Q. Assemble Vaporisers.
 - (1) Shrink-fit 32 pins AS.20669 in position at the 16 vaporiser locations, ensuring that the pins are 0.005/0.000 in. (0,13/0,00 mm) below the fairing front face.

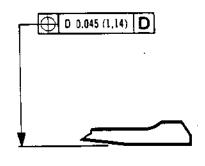
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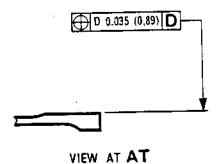
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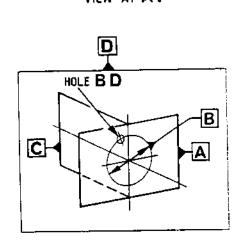


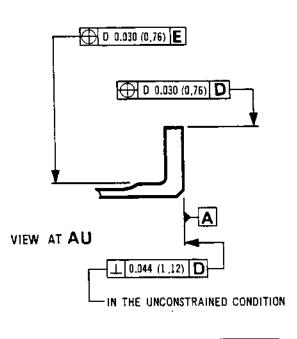


VIEW AT AR

VIEW AT AS







DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Tolerance Details Figure 417

REPAIR

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- (2) Assemble the 16 vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the salvage number for Repair No.8.
- R. Install Shank Nuts.
 - (1) Withdraw from stores 16 shank nuts AS.27871.
 - (2) Locate the shank nuts (Ref. dash item 35, Fig.401 and 414) progressively to rear flange (Ref. dash item 18, Fig.401), and swage over into countersunk holes, using swaging tool ref. tool item 17; refer to Chapter 72-09-00 Repair, for installation procedure.
 - (3) Inspect to ensure satisfactory installation of shank nuts.
- S. Inspect.
 - (1) Test the chamber for cracks using the flourescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- T. Identify.
 - (1) Mark the number SAL B.497554 and SAL B.497555 or SAL B.935554 and SAL B.935555 as appropriate (Ref. Tables 401 and 402), adjacent the existing assy. part number on the rear outer flange (Ref. dash item 15, Fig.401). Use the electro chemical or vibropercussion marking technique detailed in Chapter 72-09-00, Repair.
- U. Finally Inspect.
 - (1) Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.
 - (2) Generally clean the chamber to remove grease and foreign bodies, then place the chamber in container ref. tool item 18.



4. Special Tools, Fixtures and Equipment

| Description | Quantity | Tool No. | <u>Item</u> . | <u>Fig.No.</u> |
|-------------------------------|----------|--------------------------|---------------|----------------|
| Holding Fixture | 1 | s3s.15231000 | 1 | 402 |
| Anti-spatter Guard | 1 | s3s.15919000 | 2 3 | - |
| Holding Fixture | 1 | S3S.12437000 | | 403 |
| Cancelled | | | 4 | |
| Cancelied | | | 5 , | |
| Cancelled | | | 6 | _ |
| Retaining Strap | 1 | S3S.15526000 | 7 | 406 |
| Argon Backing Stand | 1 | \$3\$.12445000 | . 8 | 408 |
| Argon Backing Head | 1 | \$3\$.12446000 | 9 | 408 |
| Retaining Strap | 1 | s3s.15532000 | 10 | 409 |
| Cancelled | | | 11 | - |
| Cancelled | | | 12 | - |
| Welding Fixture | 1 | \$3\$.12431000 | 13 | 413 |
| Container | 1 | 838.15936000 | 14 | - |
| Cancelled | | | 15 | |
| Heat Treatment Suppor Ring | ·t 1 | s3s.12439000 | 16 | 416 |
| Swaging Tool | 1 | S3S_12440000 | 17 | - |
| Container | 1 | \$38.11698000 | 18 | - |
| Drilling Fixture | 1 | s3s.12433000 | 19 | 408B |
| Drilling Fixture | 1 | s3s_12457000 | 20 | 408B |
| Tapered Plug | 1 | \$38.12769000 | 21 | 415A |
| Wedge Segment | 12 | \$35.12770000 | 22 | 415A |
| Expanding Former | 16 | \$3\$.12772000 | 23 | 415A |
| Restraining Ring | 1 | \$35 ₁₂₇₇₁₀₀₀ | 24 | |
| Index Fixture | 1 | S3S_15924000 | 25 | 405 |
| Adapter Set | 1 | s3s.15910000 | 26 | 405 |
| | | | | |

5. Replacement Parts

| <u>Description</u> | Quantity | Part No. | I.P.C. Fig./Item |
|-----------------------------|----------|-------------|------------------|
| No.3 Outer Cooling | 1 | B.497193 | 72-41-01 |
| Ring Outer Front Chamber | 1 | B.495721PDA | 72-41-01 |
| Section Shank Nuts | 16 | AS.27871 | 72-41-01 |

6. Welding Data

- A. Process A.
 - (1) Method of Welding: Automatic circumferential argon arc butt.
 - (2) Machine: Analog 300.
 - (3) Positioner: Aga.
 - (4) Torch: M.301.
 - (5) Electrode:
 0.125 in. (3,175 mm) thoriated tungsten
 - (6) Arc Length:
 0.030 in. (0,76 mm).
 - (7) Weld Speed: 5.0 in./min. (127,00 mm/min.).
 - (8) Current: 70 amps.
 - (9) Torch Gas: 22 cu.ft/hr (11 Litres/min.) Argon at 15 psi (103 kPa).
 - (10) Backing Gas: 88 cu.ft/hr.(44 Litres/min.) Argon at 30 psi (206 kPa).

7. Serviceable Items

- A. When re-using serviceable items where the weld joint has been plasma sprayed, proceed as follows:
 - (1) Dry abrasive blast using aluminium oxide grit 18/24 mesh to remove the top two coats of magnesium zirconate for a distance of 0.250 in. (6,35 mm) from the joint. Refer to 72-09-24 Repair for procedure.
 - (2) Prepare the edge for welding using an aluminium oxide scurf mop.
 - (3) Autoweld the serviceable item as instructed in this Repair.

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(4) Inspect visually.

NOTE: The unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burr or an aluminium oxide scurf mop.

(5) Crack test the welded items using the fluorescent dye penetrant process specified in this Repair.

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COMBUSTION CHAMBER (2BR) - REPAIR REPLACEMENT OF DAMAGED SECTIONS

MODIFICATION NO. OL.8744C, OL.8851C

1. Effectivity

| <u>I.P.C.</u> | . <u>Fig.</u> | /Item | <u>Pa</u> | rt No. | |
|---------------|---------------|-------|---|--|--|
| 72-41-01 | 2 | 10 | B.934945, B.936627, B.936863, B.936869, B.936880, B.936885, B.938014, B.938017, B.938020, B.938173, B.938180, B.938183, B.938506, | B.934943, B.935462, B.936630, B.936871, B.936876, B.936882, B.936938, B.938015, B.938015, B.938021, B.938178, B.938501, B.938507, B.938510. | B.935463, B.936862, B.936867, B.936873, B.936878, B.938013, B.938016, B.938019, B.938022, B.938179, B.938182, B.938505, |

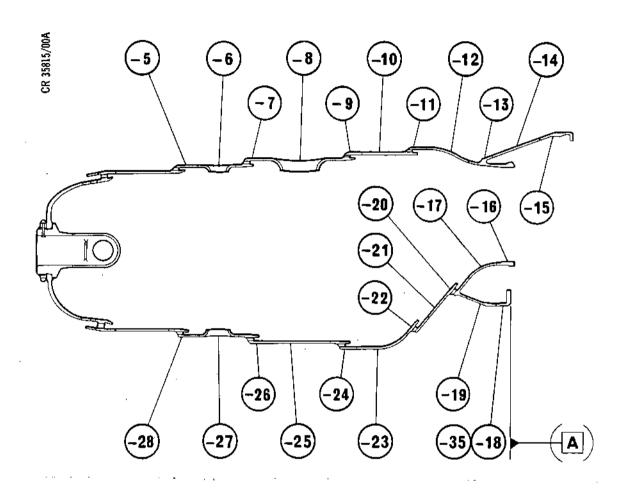
2. Introduction

A. General

- (1) This repair describes the procedure for replacing damaged sections/rings of the combustion chamber.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Cut off dimensions and minimum drop dimensions are shown on Fig. 402. The drop dimension is the important factor in all cases and must override the reference cut off dimensions.

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Combustion Chamber Details Figure 401



- (5) It is permissible to replace a number of sections/ rings by either single stage build-up onto the base unit or to assemble a number of sections/rings and then fit to base unit. However, if the latter method is used, calculation of longitudinal dimensions and machining of overlength sections becomes more difficult and time consuming.
- (6) It is not necessary to cut through the rearward adjacent section when replacing a ring. If replacing ring only, cut through the ring 0.2 in. (5,08 mm) from weld line in all cases.

| Salvage Number | Dash Item | Replacement Part |
|--------------------------|-----------|------------------|
| B. 497556 | 6 | B. 4 957 23 |
| B_497557 | | B.497197 |
| B.497558 | 7 8 | B.495725 |
| 8.497559 | 9 | B.495726 |
| B_497560 | 10 | B.495727 |
| B.497561 | 11 | B.495728 |
| B_497562 | 1 2 | B. 495739 |
| B.497563 | 13 | B.484283 |
| B.497564 | 1 4 | B.488358 |
| B.497565 | 1 5 | B.444826 |
| B.497566 | 16 | B.490070 |
| B.497567 | 17 | 8.463717 |
| B.497568 | 18 | 8-444824 |
| | 35 | AS.27871 |
| B.497569 | 19 | B.497001 |
| B.497570 | . 20 | B.481196 |
| B.497571 | 21 | B.463719 |
| B.497572 | 22 | B.481195 |
| B.497573 | 23 | B.495738 |
| B ₄ 4 97 57 4 | 24 | B.495737 |
| B. 497575 | 25 | B.495736 |
| B.497576 | 26 | B.497199 |
| B.497577 | 27 | B.495734 |

Salvage Number Identification for Combustion Chambers listed in Table 402. Table 401



Assy. Part No.

B.934496, B.934943, B.934944, B.934945, B.935462, B.935463, B.936627, B.936630, B.936869, B.936871, B.936873, B.936875, B.936876, B.936878, B.936880, B.936882, B.938013, B.938014, B.938015, B.938016, B.938017, B.938018, B.938019, B.938020.

Table 402

| Salvage Number | Dash Item | Replacement Par |
|----------------|-----------|-------------------------|
| B. 935556 | 6 | B. 495723 |
| B. 93 5 5 5 7 | 6 7 | B.497197 |
| B.935558 | 8 9 | B.495725 |
| B.935559 | | B.495726 |
| 8.935560 | 10 | B.495727 |
| 8.935561 | 11 | B.495728 |
| B.935562 | 12 | B.495739 |
| B.935563 | 13 | B.484283 |
| B.935564 | 14 | B.488358 |
| B.935565 | 15 | B.444826 |
| B.935566 | 16 | B.490070 |
| B.935567 | 17 | в.463717 |
| B.935568 | 18 | B . 444824 |
| | 35 | AS - 27 87 1 |
| B.935569 | 19 | B.497001 |
| B.935570 | 20 | B.481196 |
| B. 93 557 1 | 21 | B.463719 |
| B.935572 | 22 | в.481195 |
| B.935573 | 23 | B.495738 |
| B. 93 5 5 7 4 | ·24 | B ₄ 4 957 37 |
| B. 93 5 5 7 5 | 25 | B.495736 |
| B. 93 5 5 7 6 | 26 | B.497199 |
| B. 93 5577 | 27 | B.495734 |

Salvage Number Identification for Combustion Chambers listed in Table 404. Table 403

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Assy. Part No.

B.936862, B.936863, B.936865, B.936867, B.936884, B.936885, B.936938, B.938021, B.938022, B.938173, B.938178, B.938179, B.938180, B.938181, B.938182, B.938183, B.938501, B.938505, B.938506, B.938507, B.938508, B.938509, B.938509, B.938500

Table 404

(7) As the ends of the No.6 inner cooling ring (dash 22 section) are square to side faces and not parallel to combustion chamber axis, the cut off dimension is more easily marked by checking the 4.090/4.050 in. (103,89/102,87 mm) dimension, 4.070 in. (103,38 mm) (calculated dimension of tee head, compensating for 50 degree angle), to give a dimension of 4.568 in. (116,03 mm) for marking (Ref.Fig.402).

NOTE: As the ring is fitted at an angle of 50 degrees to the combustion chamber axis, the cutter would enter at 40 degrees to vertical to produce square ends.



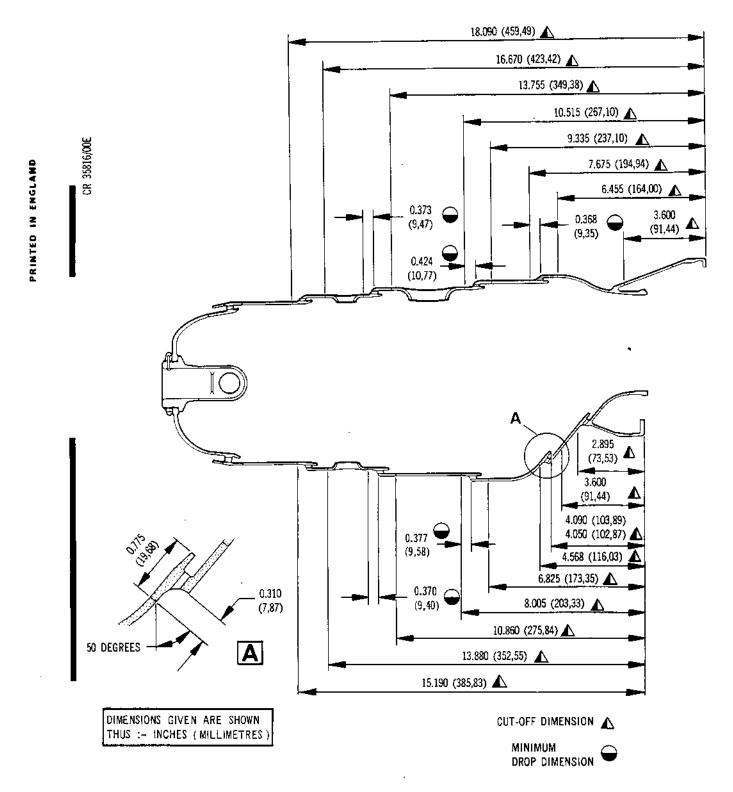
- (8) In general, fit the side of the section closest to plunged holes to base unit unless an increase in height is required to maintain longitudinal tolerances, and machine as necessary.
- (9) Rear flanges (Ref. dash items 15 and 18, Fig. 401) can be replaced without disturbing the other rings or sections. Refer to paragraphs 4 and 5 for details.
- (10) After welding, ovality and shrinkage on items indicated Z (Ref.Fig.409) may be up to minus 0.240 in. (6,096 mm) on diameter.
- (11) All welds are classified as Group 2.
- B. Repair Limitations.
 - (1) Salvages identified in Table 401 may be used in any combination with Salvages in the range B497550-89.
 - (2) Salvages identified in Table 403 may be used in any combination with Salvages in the range B935550-82.
 - (3) Serviceable items may be re-used (Refer to paragraph 9).

3. Instructions

- A. Remove Shank Nuts and Vaporisers.
 - (1) Remove the vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.
 - (2) Remove the vaporiser location pins, taking care not to damage the holes.
 - (3) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 35 and 18, Fig.401 and 414). Care must be taken not to damage the flange. Refer to 72-09-00 Repair, for removal procedure.
 - (4) Inspect to ensure satisfactory removal of the shank nuts.

REPAIR



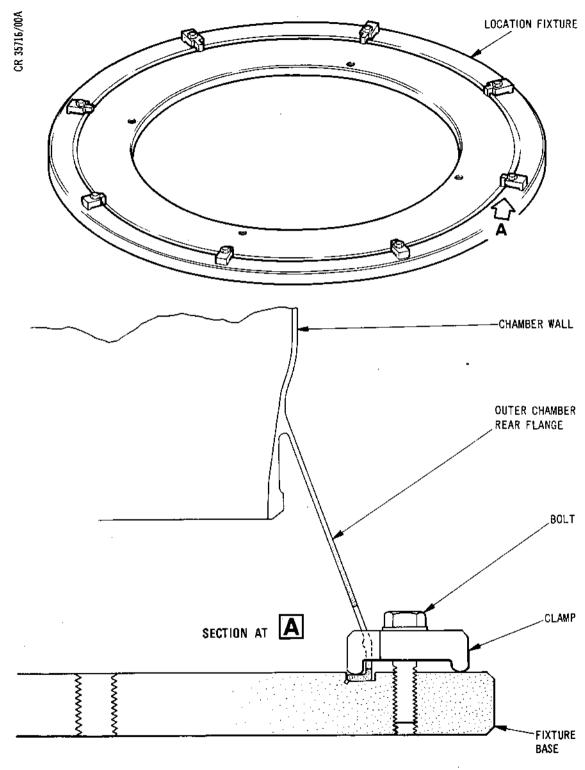


Cut-off and Drop Dimensions Figure 402



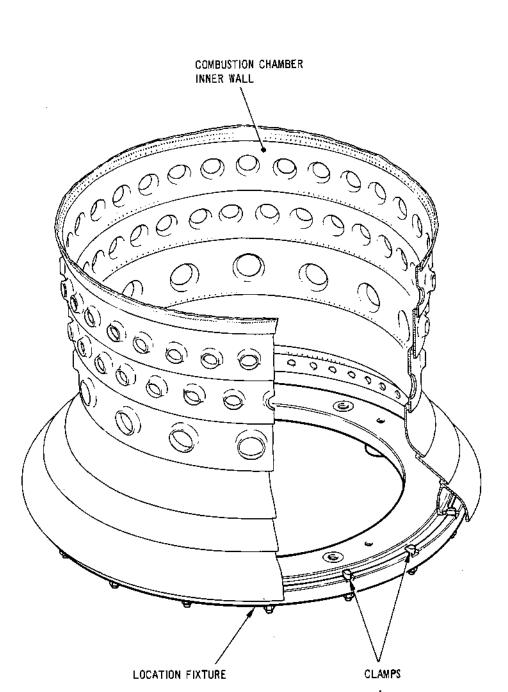
- B. Mark-off and Identify.
 - (1) Locate the chamber on its flanged end on a surface table and using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark two lines circumferentially around the ring or section to be replaced at 0.2 in. (5,1 mm) from the weld line at each end.
 - (2) Identify the inner and outer chambers as a pair before cutting.
- C. Cut Chamber.
 - (1) Locate the chamber in holding fixture ref. tool item 1 (Ref.Fig.403), using packing to support the inner chamber. Separate the chamber by cutting circumferentially around the upper line marked at para.3.B., using an argon torch and anti-spatter guard ref. tool item 2, or a mechanical cutter.
 - (2) Remove the inner chamber from the fixture.
 - (3) Cut circumferentially around the lower line marked at at para.3.8. Use holding fixture ref. tool item 1 (outer chamber) or tool item 3 (inner chamber) as appropriate.
 - (4) Remove the chamber from the fixture.
 - (5) Clean to remove spatter bead produced by plasma cutting from the inner and outer chambers. Care must be taken to ensure that no thinning of parent metal occurs.
 - (6) Inspect the inner and outer chambers for excessive distortion.
 - (7) Remove distortion if necessary using conventional hand tools.
 - (8) Inspect for satisfactory separation of sections.





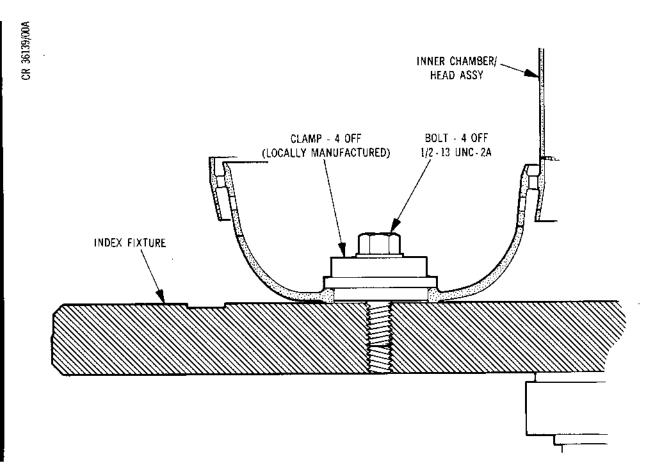
Holding Fixture Ref. Tool Item 1 Figure 403

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Holding Fixture Ref. Tool Item 3 Figure 404

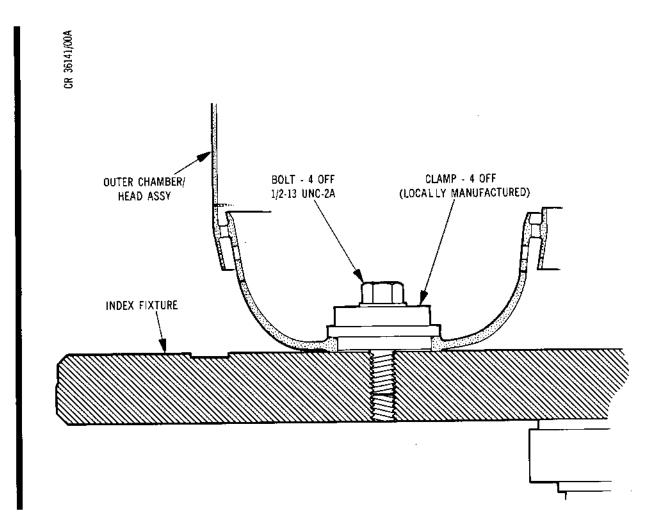
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Index Fixture Ref. Tool Item 34 Figure 405



- D. Machine Inner Chamber.
 - (1) Locate the inner chamber on a surface table locating on the datum A flange (Ref.Fig.401). Using a suitable marking medium i.e. a black Magic Marker or Spectra Blue, mark the appropriate cut-off dimension as shown at Fig.402.
 - (2) Locate a holding fixture to a vertical centre lathe, and locate the inner chamber to the fixture.
 - (a) Use fixture ref. tool item 34 if the head assembly is still attached to the inner chamber.
 - (b) Use fixture ref. tool item 3 if the head assembly is not attached.
 - (3) Turn to produce the cut-off dimension previously marked. Remove burrs and sharp edges.
 - (4) Inspect to ensure that the cut-off dimension has been achieved satisfactorily.
 - (5) Crack test the inner chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- E. Machine Outer Chamber.
 - (1) Locate the outer chamber on a surface table locating on the rear outer flange. Using a suitable marking medium i.e. a black Magic Marker or Spectra Blue, mark the appropriate cut-off dimension shown at Fig. 402.
 - (2) Locate a holding fixture to a vertical centre lathe, and locate the outer chamber to the fixture.
 - (a) Use fixture ref. tool item 34 if the head assembly is still attached to the outer chamber.
 - (b) Use fixture ref. tool item 1 if the head assembly is not attached.



Index Fixture Ref. Tool Item 34 Figure 405A



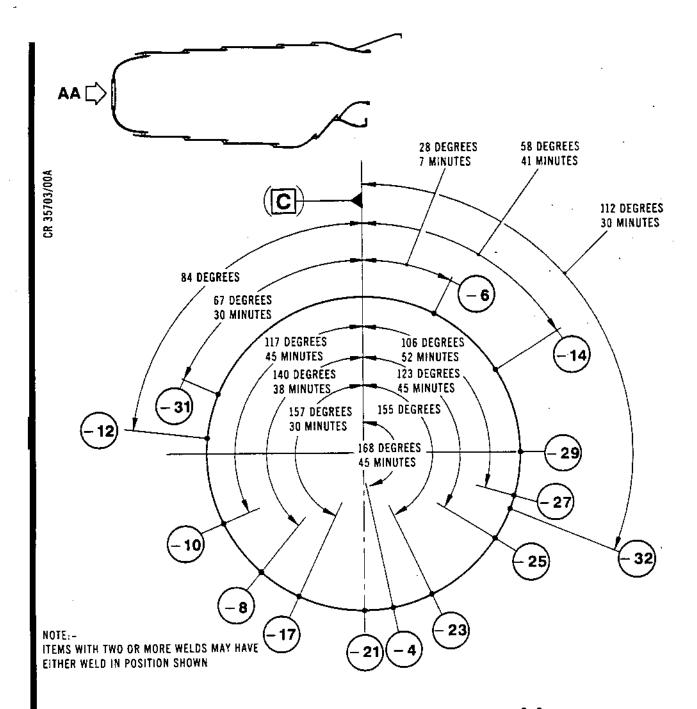
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- (3) Turn to produce the cut-off dimension previously marked. Remove burns and sharp edges.
- (4) Inspect to ensure that the cut-off dimension has been achieved satisfactorily.
- (5) Crack test the outer chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- F. Weld Replacement Section to Chamber.
 - NOTE: If items 6 and 7, or items 26 and 27 are to be replaced at the same time, an item 6/7 assembly or an item 26/27 assembly can be produced, plasma sprayed, and then replaced as one part.
 - (1) Withdraw from stores a replacement ring or section (Ref.Table 401 or 403).
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 Cleaning).
 - (3) Assemble the replacement ring or section to the chamber, using a retaining strap ref. tool items 7-13 (where applicable), ensuring the longitudinal welds are in correct angular position as shown at Fig. 406. Form the mating ends to ensure correct alignment using conventional forming tools. Mismatch must not exceed the limits shown at Fig. 407.
 - (4) Tackweld, diametrically opposite, the replacement ring or section to the chamber, using argon backing stand ref. tool item 14 and argon backing head ref. tool item 15 (Ref.Fig.4D8); refer to para.8, Process A, for inner rings or sections, and Process B for outer rings or sections.
 - (5) Remove retaining strap if fitted.

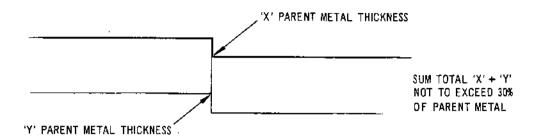




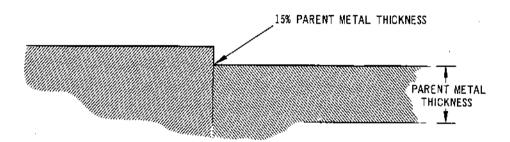
DIAGRAMMATIC VIEW IN DIRECTION OF ARROW AA
SHOWING ANGULAR POSITIONS OF LONGITUDINAL
WELDS IN THE ABOVE ITEMS

Angular Relationship of Longitudinal Welds Figure 406

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DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS

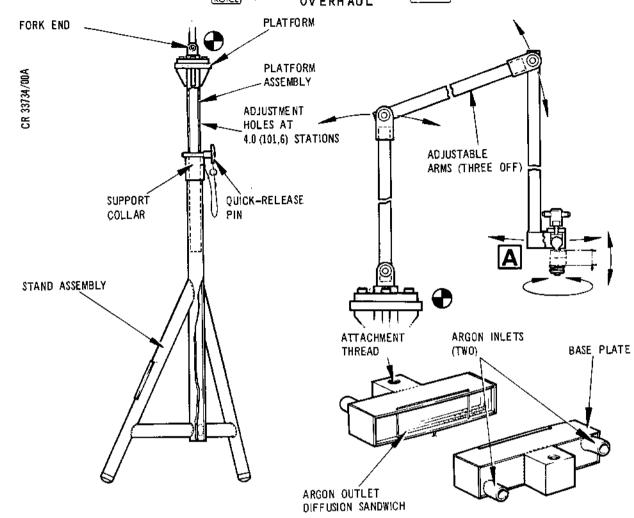


STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

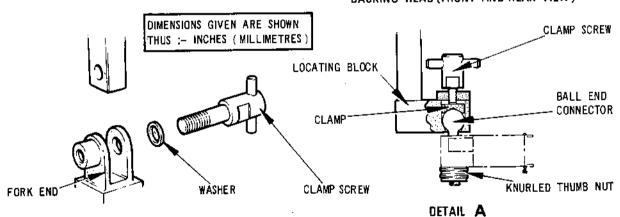
Acceptable Mismatch Figure 407

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BACKING HEAD (FRONT AND REAR VIEW)



TYPICAL FORK END DETAIL

SHOWING BACKING HEAD ATTACHMENT

Argon Backing Stand and Head Ref. Tool Items 14 and 15 Figure 408

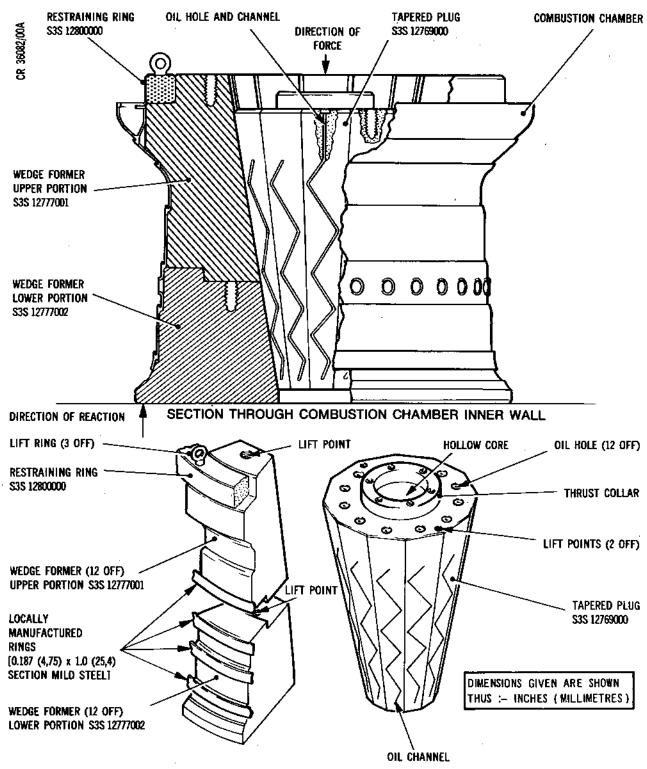
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- (6) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible then the tackwelds must be broken to remove the ring or section from the chamber, then after dressing and cleaning, the tackwelding procedure repeated.
- (7) Clamp the chamber/section assy. to a welding table and autoweld, using argon backing stand ref. tool item 14 and argon backing head ref. tool item 15 (Ref.Fig.408); refer to para.8, Process A for inner rings or sections, and Process B for outer rings or sections.
- (8) Check that the weld protrusion is complete and does not exceed 0.025 in. (0,63 mm). If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, then the ring or section must be removed by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (9) Inspect to ensure welding has been carried out satisfactorily.
- (10) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- G. Plasma Spray.
 - (1) The areas shown in Chapter 72-41-01 Repair No.14 are to be plasma sprayed. If none of these areas has been disturbed or damaged during this repair, continue at paragraph H. If plasma spraying is required, refer to Chapter 72-41-01 Repair No.14 for procedure.

H. Machine Chamber.

- (1) Locate a holding fixture to a vertical centre lathe, and locate the chamber/section to the fixture.
 - (a) Use fixture ref. tool item 1 for outer chamber/ section assemblies.
 - (b) Use fixture ref. tool item 3 for inner chamber/ section assemblies.
- (2) Machine the chamber/section to length (Ref.Fig.402). Remove burrs.
- (3) Inspect for satisfactory machining.
- (4) Crack test the chamber, using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- J. Attach Chamber/Section to Chamber/Head Assy.
 - (1) Remove the existing vaporiser seating pads from fixture ref. tool item 18 (Ref.Fig.410), and store in container ref. tool item 19. Attach items in adapter set ref. tool item 35 to fixture.
 - NOTE: When replacing sections of the combustion chamber, it is usually necessary to expand sections to match the replaced part, prior to welding. Expansion is carried out on a particular area adjacent to that being replaced. This is achieved by using segmented or split rings of local manufacture. (Use tools ref. items 27, 31, 32, 33, para.4 and Figure 408A for inner chamber and items 27, 28, 29, 30, Figure 408B for outer chamber).
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 Cleaning).

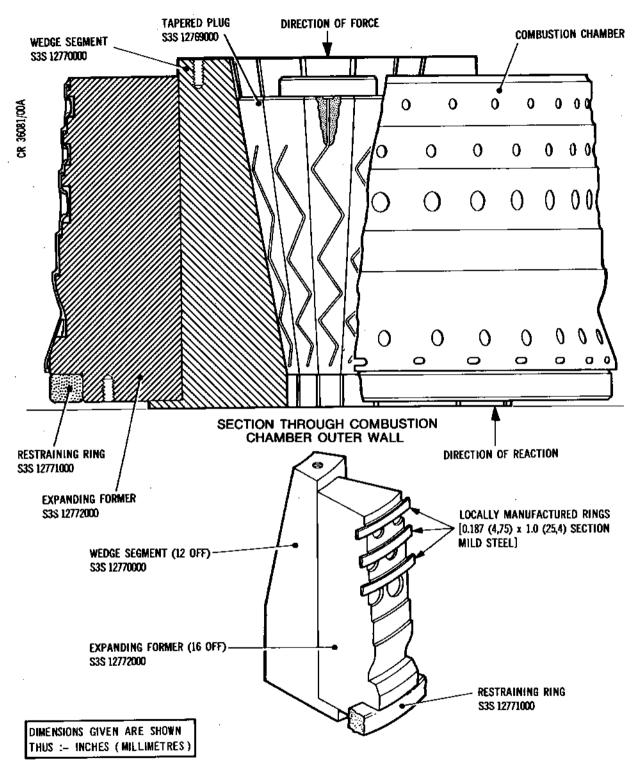




Expanding Equipment - Inner Chamber Figure 408A

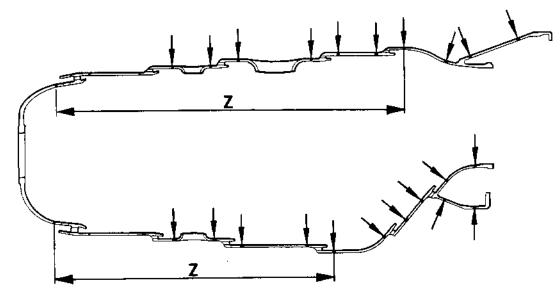
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Expanding Equipment - Outer Chamber Figure 408B

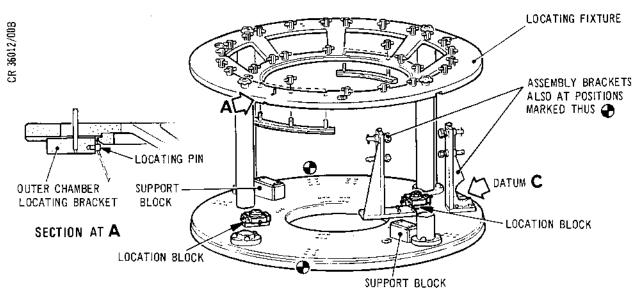
72-41-01 Repair No.11 Page 416B Dec 1/86 CR 35818/00D



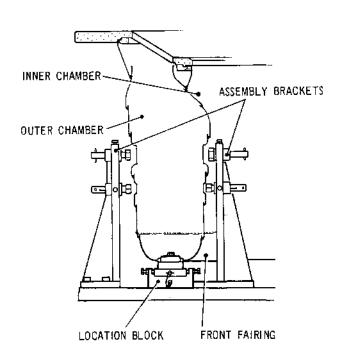
VIEW SHOWING DIRECTION OF INERT GAS ARC WELDING

Welding Details Figure 409





NOTE: ALTHOUGH THE ASSEMBLY BRACKETS ARE USED TO ACHIEVE THE CORRECT ANGULAR RELATIONSHIP OF THE INDIVIDUAL PARTS THEY MUST BE USED IN CONNECTION WITH THE STAGGERED WELD DIAGRAM (REF FIG 406)



Welding Fixture Ref. Tool Item 18 Figure 410

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(3) Assemble the outer chamber to the inner chamber using welding fixture ref. tool item 18 with adapter set ref. tool item 35 fitted (Ref.Fig.410). Ensure the longitudinal welds are in the correct position as shown at Fig.406. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown at Fig.407.

The inner chamber must be located in the NOTE: fixture using the four dowel holes shown at Section BA (Ref.Fig.414). The outer chamber is located in the fixture using the fixture Locating pin (Ref. Section A, Fig.410), engaged in the 0.900 in. (22,860 mm) diameter hole in the rear flange. It may be necessary to shim under the vaporiser location positions and wedge up the outer head assembly to overcome any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 in. (0,762 mm) at any one position and care must be taken not to damage the head assy. outer skin.

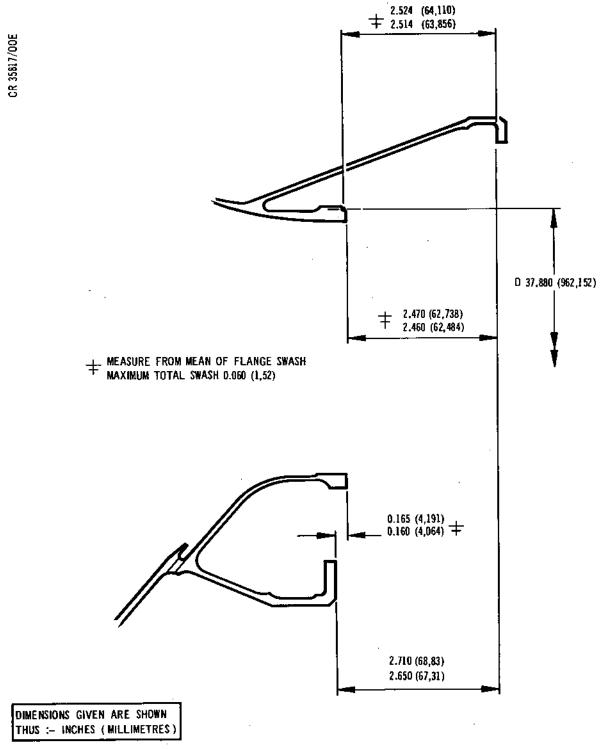
- (4) Tackweld, diametrically opposite, the chamber/section to the chamber/head assy. using argon backing stand ref. tool item 14 and argon backing head ref. tool item 15 (Ref.Fig.408); refer to para.8, Process A for inner chamber/sections, and Process B for outer chamber/sections.
- (5) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the chamber/section from the chamber/head assy. and after dressing and cleaning, the tackwelding procedure repeated.

- (6) Remove the combustion chamber assy. from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 14 and argon backing head ref. tool item 15 (Ref.Fig.408), autoweld the chamber/ section to the chamber/head assy. Refer to para.8, Process A for inner chamber/sections, and Process B for outer chamber/sections.
- (7) Check that the weld protrusion is complete and does not exceed 0.025 in. (0,63 mm). If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the chamber/section must be removed from the chamber/head assy. by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (8) Inspect to ensure the 2.710/2.650 in. (68,83/67,31 mm) dimension (Ref.Fig.411) has been achieved and that the welding has been carried out satisfactorily.
- (9) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

K. Heat Treat.

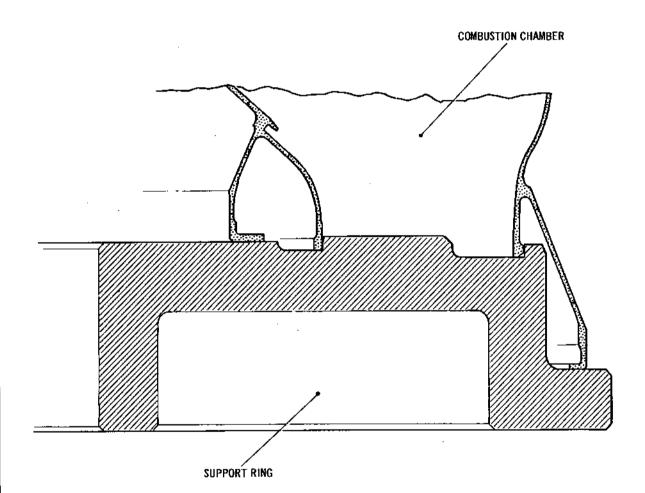
- (1) Locate chamber to heat treatment support ring reftool item 21 (Ref.Fig.412) and place component/fixture assy. in a vacuum/argon furnace.
- (2) Heat treat chamber to 800 deg.C. plus/minus 5 deg.C. for 8 hours. Cool in air.
- (3) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.





Rear Flange Drop Dimension Figure 411





Heat Treatment Support Ring Ref. Tool Item 21 Figure 412

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L. True-up Chamber.

- (1) Generally true-up the chamber, using standard shop tools to achieve the tolerances shown at Fig. 413.
- (2) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

M. Assemble Vaporisers.

- (1) Shrink-fit 32 pins AS.20669 in position at the 16 vaporiser locations, ensuring that the pins are 0.005/0.000 in. (0,13/0,00 mm) below the fairing front face.
- (2) Assemble the 16 vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.

N. Install Shank Nuts.

- (1) Withdraw from stores 16 shank nuts AS.27871.
- (2) Install the shank nuts (Ref. dash item 35, Fig.401 and 414) in the rear flange (Ref. dash item 18, Fig.401), and swage over into countersunk holes, using swaging tool ref. tool item 22; refer to Chapter 72-09-00, Repair, for installation procedure.
- (3) Inspect to ensure satisfactory installation of shank nuts.

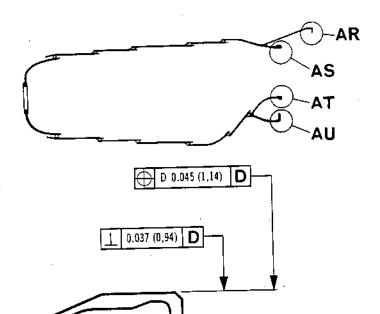
P. Inspect.

(1) Test the chamber for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

Q. Identify.

(1) Mark the salvage number (Ref. Tables 401 and 403) or R11 adjacent the existing assy. part number on the rear outer flange (Ref. dash item 15, Fig.401), using the electro chemical or vibro-percussion marking technique detailed in Chapter 72-09-00, Repair.

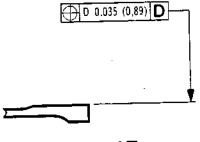




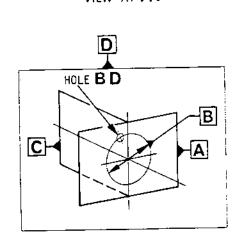
D 0.045 (1.14) D

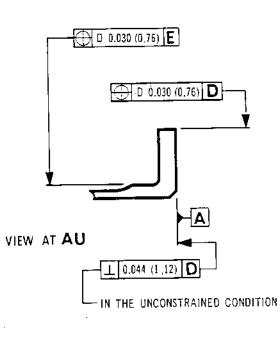
VIEW AT AR

VIEW AT AS



VIEW AT AT



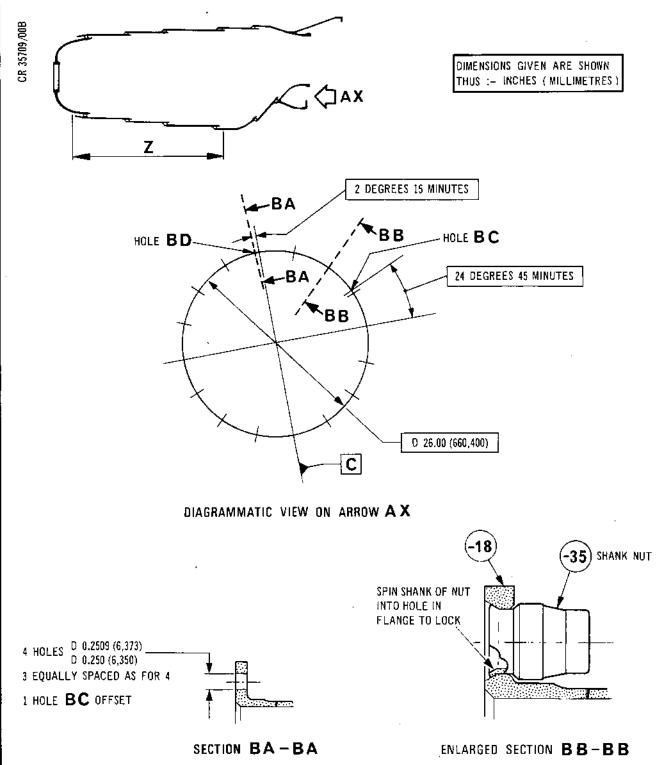


DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Tolerance Details Figure 413

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Dowel Hole and Shank Nut Details Figure 414

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R. Finally Inspect.

- (1) Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.
- (2) Generally clean the chamber to remove grease and foreign bodies, then place the chamber in container ref. tool item 23.

4. Replacing the Rear Outer Flange

- A. Remove Shank Nuts.
 - (1) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 35 and 18, Fig.401). Care must be taken not to damage the flange. Refer to 72-09-00, Repair, for removal procedure.
 - (2) Inspect to ensure the satisfactory removal of the shank nuts.

B. Mark-off.

- (1) Locate the chamber on its flanged end on a surface table and using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue, mark a line circumferentially around the rear flange at 0.2 in. (5 mm) below the weld line.
- (2) Record all markings on the rear flange for marking on the replacement rear flange.

C. Remove Rear Flange.

- (1) Locate the chamber in holding fixture ref. tool item 1 (Ref.Fig.403), using packing to support the inner chamber. Remove the flange by cutting along the line marked at para.4.8. using an argon torch.
- (2) Remove the chamber from the fixture.
- (3) Clean to remove spatter bead produced by plasma cutting, from the chamber. Care must be taken to ensure that no thinning of parent metal occurs.
- (4) Inspect the chamber for excessive distortion. If necessary, remove the distortion using conventional hand tools.

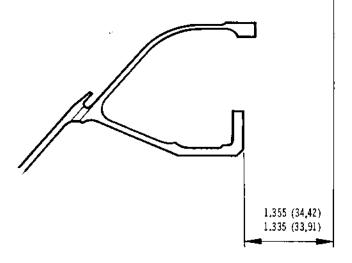


- D. Machine the Chamber.
 - (1) Locate holding fixture ref. tool item 4 fitted with adapter set ref. tool item 6 to a vertical centre lathe.
 - (2) Locate the chamber to the fixture and set true.
 - (3) Machine the chamber back to the weld line to produce the 1.355/1.335 in. (34,42/33,91 mm) dimension (Ref. Fig.415). Remove burns and sharp edges.
 - (4) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- E. Weld Replacement Rear Flange.
 - (1) Withdraw from stores a replacement rear flange B.444826PM1.
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 - Cleaning).
 - <u>CAUTION:</u> MISMATCH MUST NOT EXCEED THE LIMITS SHOWN AT FIG. 407.
 - (3) Assemble the replacement outer rear flange to the outer chamber using retaining strap ref. tool item 12. Form the mating ends to ensure correct alignment using conventional forming tools.
 - (4) Tackweld, diametrically opposite, the replacement outer rear flange to the outer chamber, using Argon backing stand ref. tool item 14 and Argon backing head ref. tool item 15; refer to para.8, Process D, for welding data and to Fig. 408.
 - (5) Check to ensure that no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the replacement outer rear flange from the outer chamber, then after suitable dressing and cleaning, the tackweld procedure repeated.





DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)



Rear Flange Cut-off Dimension Figure 415

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(6) Clamp the replacement rear outer flange/chamber assembly to the welding table and using Argon backing stand ref. tool item 14 and Argon backing head ref. tool item 15 autoweld the replacement rear outer flange to the outer chamber; refer to para.8, Process D, for welding data and to Fig. 408.

CAUTION: NO THINNING OF PARENT METAL OR GRINDING IS PERMITTED.

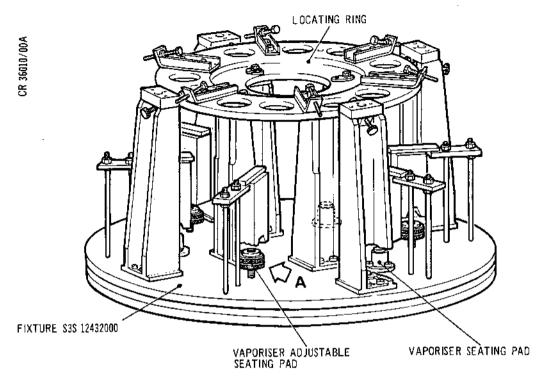
- (7) Check that the weld protrusion does not exceed the permissible amount as shown at Fig. 407. If unsatisfactory then dress the welds using a cutter or aluminium oxide scurf mop. If still unsatisfactory after dressing then the two parts must be separated by Plasma cutting and machining, as detailed previously, and the whole procedure repeated.
- (8) Test the welded area for cracks using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- F. Post Weld Heat Treatment.
 - (1) Clean the chamber to remove any traces of marking mediums.
 - (2) Position the chamber in a vacuum/argon furnace, on the front fairing end; heat treat the chamber to a temperature of 800 deg.C. plus/minus 5 deg.C. Soak at this temperature for eight hours, then rapid inert gas quench.
 - (3) Descale the chamber using the process specified for the component in 72-41-01, Cleaning.
- G. True-up Chamber.
 - (1) Using conventional hand tools true up the chamber completely (Ref.Fig.413).
 - (2) Check that the chamber has been trued up satisfactorily.
 - (3) Test for cracks by the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

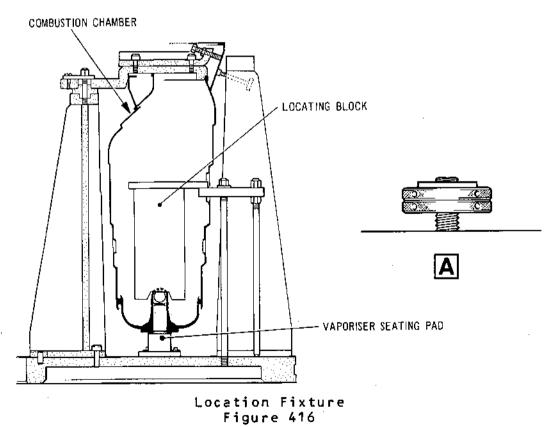


- H. Finish Machine Rear Outer Flange.
 - (1) Locate the fixture ref. tool item 24 onto a suitable vertical centre lathe, then locate the chamber into the fixture (Ref.Fig.416).
 - (2) Finish turn the 40.810/40.770 in. (1036,57/1035,56 mm) outside diameter. Finish turn the flange inner face producing the 2.470/2.460 in. (62,74/62,48 mm) dimension to the outer chamber inner flange end face and the 2.690/2.670 in. (68,33/67,82 mm) dimension to the inner chamber outer flange end face, and finish turn the adjacent diameter to a length of 0.300 in. (7,62 mm) producing the two 0.080 in. (2,03 mm) corner rads. and the 0.080/0.090 in. (2,03/2,29 mm) wall thickness. Turn to produce the 20 deg angled face adjacent the inner rad. Finish turn the 39.980 in. (1015,49 mm) inside diameter. Finish face the outer flange face producing the 0.105/0.100 in. (2,67/ 2,54 mm) flange thickness and produce the 0.050 in. $(1,27 \text{ mm}) \times 45 \text{ deg chamfer (Ref.Fig.417)}$

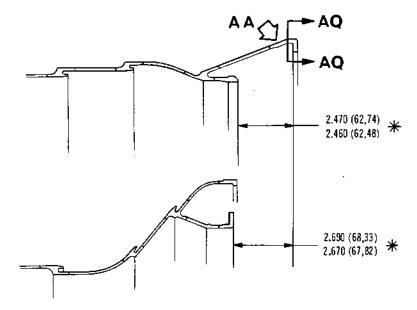
CAUTION: NO THINNING OF PARENT METAL OR GRINDING IS PERMITTED.

- (3) Remove any burrs produced at para.(2) using a cutter or aluminium oxide scurf mop.
- (4) Check to ensure the correct dimensions have been produced (Ref.Fig.417), at para.(2), and that no thinning of parent metal has occurred at para.(3).
- J. Produce Holes and Apertures.
 - NOTE: Before commencement of machining, ensure the chamber is set in relation to the engine horizontal centre line, which can be found by its relationship to hole BC (Ref_Fig_414).
 - (1) Locate and clamp the chamber to a suitable jig boring machine.
 - (2) Drill and ream two holes 0.1495 in. (3,80 mm) in the position of the two No.10 (0.190 in. or 4,90 mm) 32 UNF-2B holes in the flange, either side of the horizontal centre line, as shown at Fig.418.

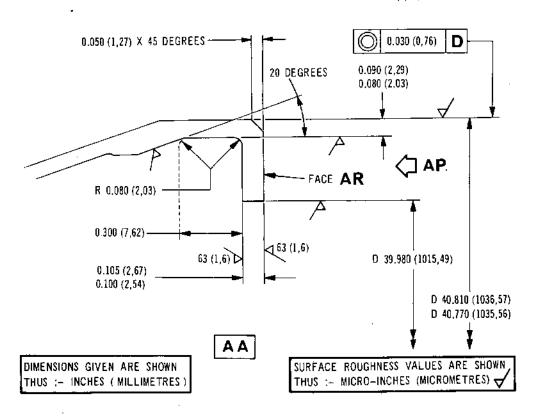




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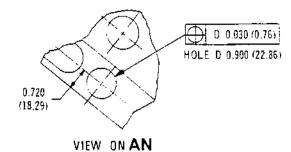


* THIS DIMENSION TO BE FROM THE MEAN OF FLANGE SWASH.
MAXIMUM TOTAL SWASH 0.060 (1,52)

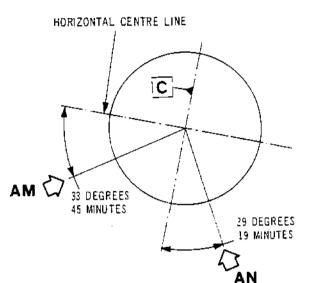


Machining Details Figure 417

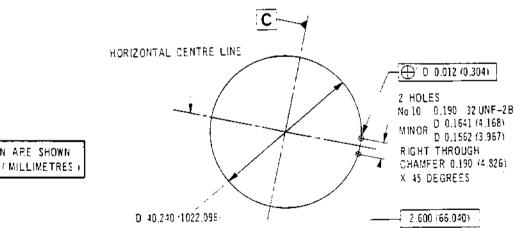
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CR 36008/00A



DIAGRAMMATIC VIEW ON AP (SEE FIG 417)



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

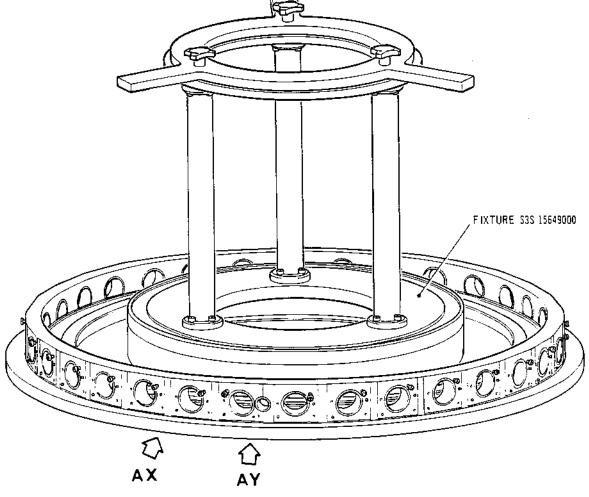
DIAGRAMMATIC VIEW ON AP (SEE FIG 417)

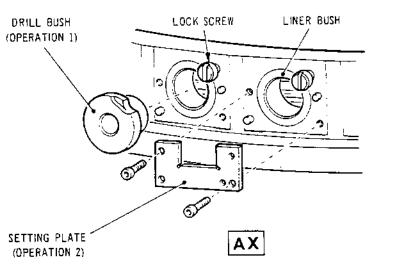
Machining Details Figure 418

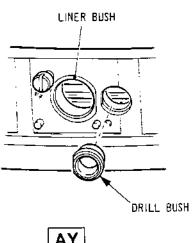
> REPAIR 72-41-01 Repair No.11 Page 433 Jan 4/93



CR 34951/00A



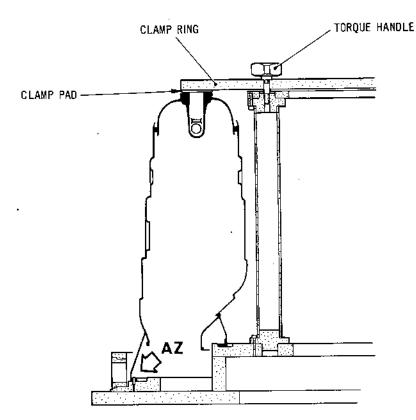


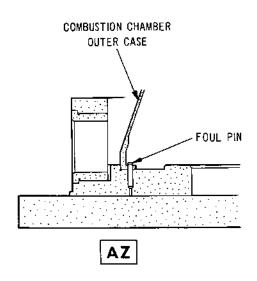


Location Fixture Figure 419 (Sheet 1 of 2)

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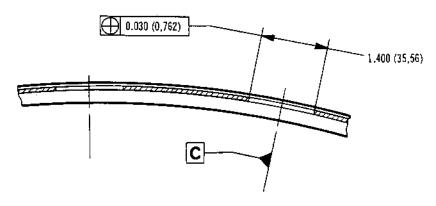
Location Fixture Figure 419 (Sheet 2 of 2)

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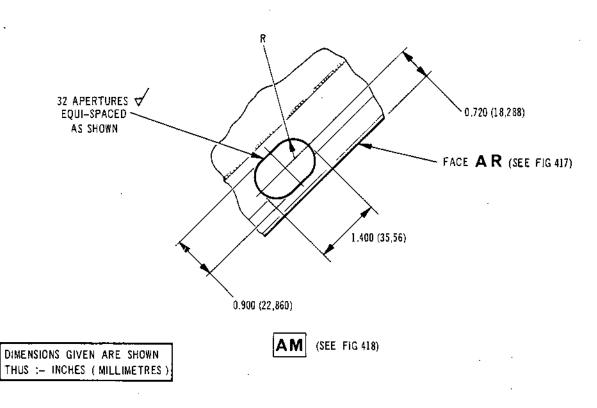


- (3) Remove the chamber from the machine.
- (4) Locate fixture ref. tool item 25, onto a suitable jig boring machine, then clamp the chamber into the fixture, locating the two dowels in the two holes produced at para.(2), (Fig.419).
- (5) Produce the 0.900 in. (22,86 mm) diameter hole as shown at view AN, Fig.418.
- (6) Drill and mill to produce the 32 apertures equi-spaced as shown at Fig. 420.
- (7) Remove the fixture/chamber assembly from the machine.
- (8) Locate and clamp the chamber to a suitable jig boring machine.
- (9) Open out the two holes produced at para.(2) to produce the two identification plate holes No.10 (0.190 in. or 4,90 mm) 32 UNF-2B through the flange, either side of the horizontal centre line, as shown at Fig.418.
- (10) Remove the chamber from the machine.
 - CAUTION: NO THINNING OF PARENT METAL OR GRINDING IS PERMITTED.
- (11) Remove any burrs using a cutter or aluminium oxide scurf mop.
- (12) Check that the identification plate holes, the 0.900 in. (22,86 mm) hole and the 32 apertures are in the correct position, and produced to the correct size, (Figs.418 and 420). Check that no thinning of parent metal has occurred during removal of burrs.
- K. Re-install Self-locking Shank Nuts.
 - (1) Withdraw from stores sixteen self-locking shank nuts AS.27871.





SECTION AQ-AQ (SEE FIG 417)



Aperture Details Figure 420

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(2) Install the self-locking shank nuts in the rear flange (Fig. 414), and swage over into the countersunk holes; refer to Standard Practices 72-09-00, Repair, for installation of nuts.

NOTE: All swaging must be flush with the flange.

- (3) Check the self-locking shank nuts have been installed correctly.
- L. Finally Inspect.
 - (1) Test the chamber for cracks by the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
 - (2) Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.
- M. Identify.
 - (1) Using the vibro-percussion method (Ref.72-09-00, Repair), re-mark all the markings recorded at para. 4.B.(2) and replace the identification plate.
 - (2) Using the vibro-percussion method (Ref.72-09-00, Repair), mark the salvage number (Ref. Tables 401 and 403) or R11 adjacent to the standard part number.

5. Replacing the Rear Inner Flange

- A. Remove the Shank Nuts.
 - (1) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 35 and 18, Fig.401). Refer to 72-09-00, Repair, for removal procedure.
 - (2) Inspect to ensure the satisfactory removal of the shank nuts.
- B. Remove the Rear Inner Flange.
 - (1) Mark a line circumferentially around the rear inner flange 0.2 in. (5 mm) away from the weld line.
 - (2) Locate the chamber in holding fixture ref. tool item 4, using adapter set ref. tool item 6 (Ref. Fig. 4D5).

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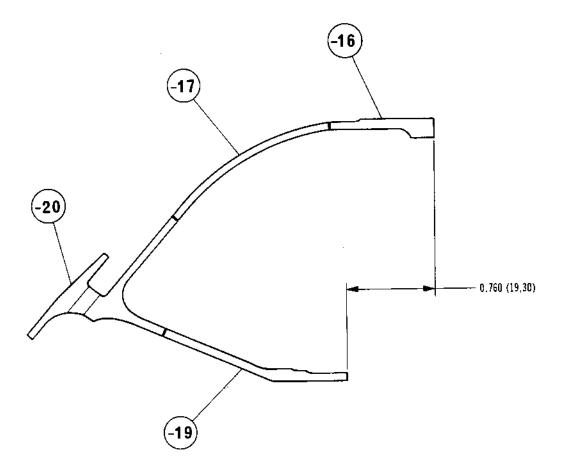


- (3) Remove the flange by cutting along the line marked using an argon torch.
- (4) Remove the chamber from the fixture.
- (5) Clean to remove spatter bead produced by plasma cutting, from the chamber. Care must be taken to ensure that no thinning of parent metal occurs.
- (6) Inspect the chamber for excessive distortion. If necessary, remove the distortion using conventional hand tools.
- C. Machine the Chamber.
 - (1) Locate holding fixture ref. tool item 4 fitted with adapter set ref. tool item 6 to a vertical centre lathe.
 - (2) Locate the chamber to the fixture, and set true.
 - (3) Machine the chamber back to the weld line to produce the 0.760 in. (19,30 mm) dimension (Ref.Fig.421).

 Remove burns and sharp edges.
 - (4) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- D. Weld Replacement Rear Flange.
 - (1) Withdraw from stores a replacement rear flange B.444824PM1.
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref. 72-09-00 - Cleaning).

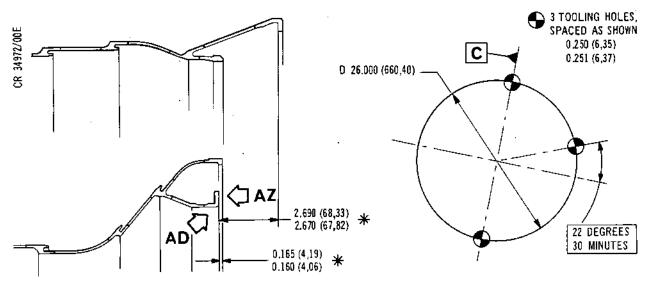
<u>CAUTION:</u> MISMATCH MUST NOT EXCEED THE LIMITS SHOWN AT FIG. 407.





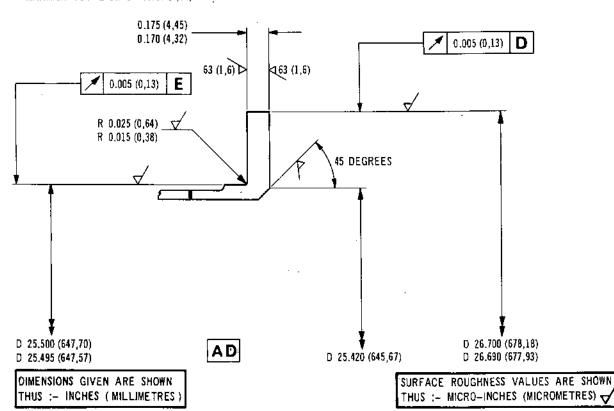
Machining Details Figure 421





DIAGRAMMATIC VIEW ON AZ

* THIS DIMENSION TO BE FROM THE MEAN OF FLANGE SWASH. MAXIMUM TOTAL SWASH 0.060 (1,52)



Machining Details Figure 422

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- (3) Assemble the replacement inner rear flange to the inner chamber using retaining strap ref. tool item 13, ensuring the three tooling holes (Ref.Fig.422) are in relation to the chamber vertical centre line (Datum C). Form the mating ends to ensure correct alignment using conventional forming tools.
- (4) Tackweld, diametrically opposite, the replacement inner rear flange to the inner chamber using Argon backing stand, ref. tool item 14 and Argon backing head ref. tool item 15; refer to paragraph 8, Process C, for welding data and to Fig. 408.
- (5) Check to ensure that no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the replacement section from the inner chamber, then after suitable dressing and cleaning, the tackwelding procedure repeated.
- (6) Clamp the replacement inner rear flange/chamber assembly to the welding table and using Argon backing stand ref. tool item 14 and Argon backing head ref. tool item 15 autoweld the replacement inner rear flange to the inner chamber; refer to paragraph 8, Process C, for welding data and to Fig. 408.

CAUTION: NO THINNING OF PARENT METAL OR GRINDING IS PERMITTED.

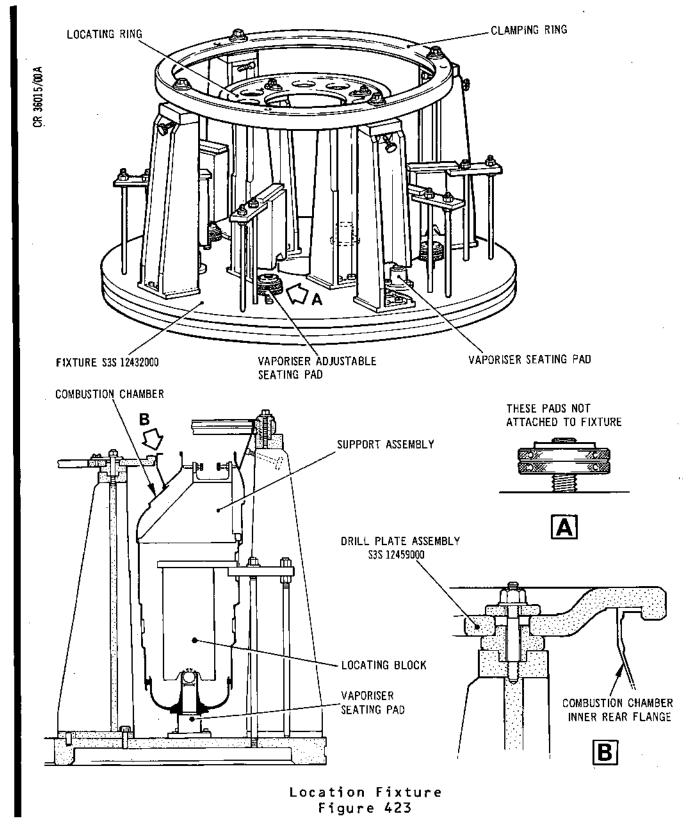
- (7) Check that the weld protrusion does not exceed the permissible amount as shown at Fig.407. If unsatisfactory, dress the welds using a cutter or aluminium oxide scurf mop. If still unsatisfactory after dressing, then the replacement rear inner flange must be removed by Plasma cutting and machining, as detailed previously and the whole procedure repeated.
- (8) Test the welded area for cracks by the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

1



- E. Post Weld Heat Treatment.
 - (1) Clean the chamber to remove any traces of marking mediums.
 - (2) Position the chamber in a vacuum/argon furnace, on the front fairing end; heat-treat the chamber to a temperature of 800 deg.C. plus/minus 5 deg.C. Soak at this temperature for eight hours, then rapid inert gas quench.
 - (3) Descale the chamber using the process specified for the component in 72-41-01, Cleaning.
- F. True-up Chamber.
 - (1) Using conventional hand tools true up the chamber completely (Ref.Fig.413).
 - (2) Check that the chamber has been trued up satisfactorily.
 - (3) Test for cracks by the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- G. Finish Machine Rear Inner Flange.
 - (1) Locate the fixture ref. tool item 24 onto a suitable vertical centre lathe, then locate the chamber into the fixture (Fig. 423).
 - (2) Finish turn the datum A flange face producing the 0.165 in./0.160 in. (4,191 mm/4,064 mm) and the 2.690 in./2.670 in. (68,326 mm/67,818 mm) dimensions, and the adjacent 45 degree chamfer to the 25.42 in. (645,668 mm) dimension. Finish turn the 26.700 in./26.690 in. (678,180 mm/677,926 mm) outside diameter. Finish turn the inner flange face producing the 0.175 in./0.170 in. (4,445 mm/4,318 mm) flange thickness, and finish turn the adjacent 25.500 in./25.495 in. (647,700 mm/647,573 mm) diameter producing the 0.025 in./0.015 in. (0,635 mm/0,381 mm) corner radius (Ref.Fig.422).



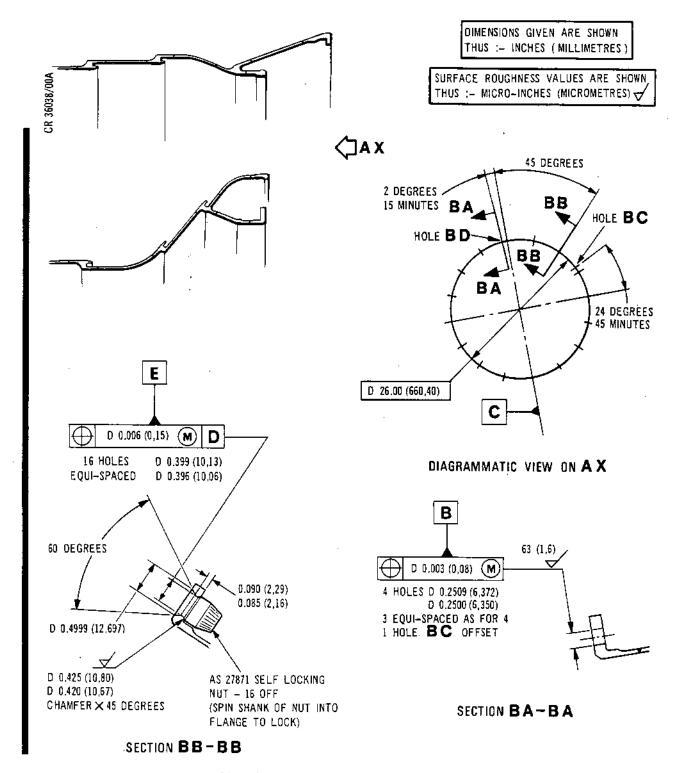


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- (3) Remove chamber from fixture and fixture from machine.
 - <u>CAUTION:</u> NO THINNING OF PARENT METAL OR GRINDING IS PERMITTED.
- (4) Remove any burrs produced at para.(2) using a cutter or aluminium oxide scurf mop.
- (5) Check to ensure the correct dimensions have been produced, (Ref.Fig.422) at para.(2), and that no thinning of parent metal has occurred at para.(4).
- H. Produce Shank Nut and Dowel Holes.
 - (1) Locate fixture ref. tool item 24 onto a suitable radial drilling machine, then locate the chamber into the fixture, and the drilling template ref. tool item 26 into position (Fig. 423).
 - (2) Drill and ream sixteen holes 0.399in/0.396 in.
 (10,134 mm/10,058 mm) diameter, equi-spaced. Countersink the holes 0.4999 in. (12,697 mm) by 60 degrees, producing the 0.090 in./0.085 in. (2,286 mm/2,159 mm) dimension, and chamfer 0.425 in./0.420 in. (10,795 mm/10,668 mm) diameter by 45 degrees (Fig.424).
 - (3) Drill and ream four holes 0.2509 in./0.2500 in. (6,3728 mm/6,35 mm), three equi-spaced as for four and one hole (AV) offset as shown (Fig.424).
 - (4) Remove the chamber from the fixture and the fixture from the machine.
 - CAUTION: NO THINNING OF PARENT METAL OR GRINDING IS PERMISSIBLE.
 - (5) Remove any burrs using a cutter or aluminium oxide scurf mop.
 - (6) Check that the shank nut and dowel holes are in the correct position and produced to the correct size. Check that no thinning of parent metal has occurred during removal of burrs.





Shank Nut and Dowel Hole Details Figure 424

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- J. Re-install Self-locking Shank Nuts.
 - (1) Withdraw from stores sixteen self-locking shank nuts AS.27871.
 - (2) Install the self-locking shank nuts in the rear flange (Fig. 424), and swage over into the countersunk holes; refer to Standard Practices 72-09-00, Repair, for installation of nuts.

NOTE: All swaging must be flush with the flange.

- (3) Check that the self-locking nuts have been installed correctly.
- K. Identify.
 - (1) Using the vibro-percussion engraving method (Ref. 72-09-00, Repair), mark the salvage number (Ref. Tables 401 and 403) or R11 adjacent to the standard part number.
- L. Finally Inspect.
 - (1) Test the chamber for cracks by the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
 - (2) Finally inspect the chamber to ensure that the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.
 - (3) Generally clean the chamber to remove grease and foreign bodies, then place the chamber in container ref. tool item 23.



6. Special Tools, Fixtures and Equipment

| Description | Qty. | Tool No. | <u>Item</u> |
|------------------------------------|---------|----------------------------------|---------------------------------|
| Holding Fixture | 1 | s3s.15231000 | 1 |
| Anti-spatter Guard | 1 | s3s.15919000 | 2 |
| Holding Fixture | 1 | \$3\$.12437000 | 3 |
| Cancelled | | | 4 |
| Cancelled | | | 3 |
| Cancelled | 1 | \$3\$.15532000 | 2 3 4 5 6 7 8 |
| Retaining Strap | 1 | \$3\$.15533000 \$3\$.15533000 | Ŕ |
| Retaining Strap | 1 | \$3\$.15534000 | 9 |
| Retaining Strap Retaining Strap | 1 | s3s.15535000 | 1Ó |
| Retaining Strap | 1 | s3s.15536000 | 11 |
| Retaining Strap | 1 | S3S.15648000 | 1 2 |
| Retaining Strap | 1 | S3S.15689000 | 13 |
| Argon Backing Stand | 1 | \$3\$.12445000 | 14 |
| Argon Backing Head | 1 | \$3\$.1 2446000 | 15 |
| Masking Bung | 1 | \$3\$. 15912000 | 16 |
| Masking Bung | 1 | s3s.15915000 | 17 |
| Welding Fixture | 1 | s3s.12431000 | 18 |
| Container | 1 | \$3\$.1 5936000 | 19 |
| Cancelled | _ | 40/70000 | 20 |
| Support Ring | 1 | S3S.12439000 | 21 |
| Swaging Tool | 1 | S3S.12440000 | 22 |
| Container | 1 | \$3\$.11698000 | 23 24 |
| Holding Fixture | 1 | \$3\$.12432000 | 25 |
| Holding Fixture | 1 | \$38.15649000 | 26 |
| Drilling Template | 1 | \$3\$.12459000 | 20 27 |
| Tapered Plug | 1 | \$3\$.12769000 \$3\$.12770000 | 28 |
| Wedge Segment | 12 1 | \$35.12770000 | 29 |
| Restraining Ring | 16 | \$38.12772000 | 30 |
| Expanding former | 12 | \$3\$.12777001 | 31 |
| Wedge Former | 12 | \$35.12777007 \$35.12777002 | 32 |
| Wedge Former | 1 | \$35.12777002 | 33 |
| Restraining Ring | 1 | \$3 \$. 12800000 | 34 |
| Index Fixture | 1 | \$3\$.15924000 \$3\$.15910000 | 35 |
| Adapter Set | 1 | 355.15510000 | J J |

7. Replacement Parts

Refer to Tables 401 and 403.



8. Welding Data

- A. Process A.
 - (1) Method of Welding:
 Automatic circumferential argon arc butta
 - (2) Machine:
 Analog 300.
 - (3) Positioner:
 Aga.
 - (4) Torch: Interlas 301 water cooled.
 - (5) Electrode:

 0.125 in. (3,175 mm) thoriated tungsten.
 - (6) Arc Length: 0.040 in. (1,02 mm).
 - (7) Weld Speed: 7.0 in./min. (177,8 mm/min.).
 - (8) Current: 70-74 amps.
 - (9) Downslope Time:
 10 sec.

(10) Torch Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(11) Shroud Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(12) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(13) Filler Wire:

16 SWG (1,63 mm) MSRR.9500/16.

(14) Direction of weld from outside.

B. Process B.

(1) Method of Welding:
Automatic circumferential argon arc butt.

(2) Machine:

Analog 300.

(3) Positioner:

Aga.

(4) Torch:

M301.

(5) Electrode:

0.125 in. (3,18 mm) thoriated tungsten.

(6) Arc Length:

0.030 in. (0.76 mm)

(7) Weld Speed:

5.0 in./min. (127,0 mm/min.).



(8) Current:

70 amps.

(9) Torch Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(10) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(11) Filler Wire:

16 SWG (1,63 mm) MSRR.9500/16.

(12) Direction of weld from outside.

C. Process C.

(1) Method of welding:
Automatic circumferential T.I.G. arc butt.

(2) Machine:

250 amp rectifier.

(3) Torch:

Water cooled, 0.5 in. (12,7 mm) bore shield.

(4) Current:

68-72 amps.

(5) Electrode:

0.094 in. (2,4 mm) diameter tungsten.

(6) Filler wire:

20 swg (0,92 mm) MSRR.9500/16.

- (7) Argon to torch:15 Litres/min. or 30 cu ft/hr.
- (8) Backing:25 Litres/min. or 50 cu ft/hr.
- (9) Weld speed:
 3.0 in./min. (76,2 mm/min.).
- (10) Tackweld joints at 1.0 in. (25,4 mm) intervals:

 Tacks to be 0.1 in. (2,5 mm) long.
- D. Process D.
 - (1) Method of welding:
 Automatic circumferential T.I.G. arc butt.
 - (2) Machine:150 amp rectifier.
 - (3) Torch:
 Air cooled, 0.375 in. (9,53 mm) bore shield.
 - (4) Current: 95-105 amps.
 - (5) Electrode:

 0.094 in. (2,4 mm) diameter tungsten.
 - (6) Filler wire:
 None.
 - (7) Argon to torch:
 20 Litres/min. or 40 cu ft/hr.



(8) Backing:

35 Litres/min. or 70 cu ft/hr.

(9) Weld speed:

5.0 in./min. (127,0 mm/min.).

(10) Tackweld joints at 1.0 in. (25,4 mm) intervals.

9. <u>Serviceable Items</u>

- A. When re-using serviceable items where the weld joint has been plasma sprayed, proceed as follows:
 - (1) Dry abrasive blast using aluminium oxide grit 18/24 mesh to remove the top two coats of magnesium zirconate for a distance of 0.250 in. (6,35 mm) from the joint. Refer to 72-09-24, Repair, for procedure.
 - (2) Prepare the edge for welding using an aluminium oxide scurf mop.
 - (3) Autoweld the serviceable item as instructed in this Repair.
 - (4) Inspect visually.
 - NOTE: The unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary, for inspection purposes, this oxide layer may be removed with a rotary burr or an aluminium oxide scurf mop.
 - (5) Crack test the welded items using the fluorescent dye penetrant process specified in this Repair.



COMBUSTION CHAMBER - REPAIR SERMALOY J COATING ON NO.2 OUTER COOLING RING

MODIFICATION NO.OL.8831C

Effectivity

| I.P.C. | Fig./Item | Part No. |
|------------------|-----------|--|
| 72-41-0 1 | 2 10 | B.936862 B.936863 B.936627 B.936630 B.935462 B.935463 B.934944 B.934945 |

2. Introduction

A. General

- (1) This repair describes the process for removing corrosion from the two areas upstream of the igniter ports on the No.2 outer cooling ring, and applying a Sermaloy J coating.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (5) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (6) Surface texture is to be 125 micro inches (3,2 micrometres) unless otherwise stated.
- (7) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.



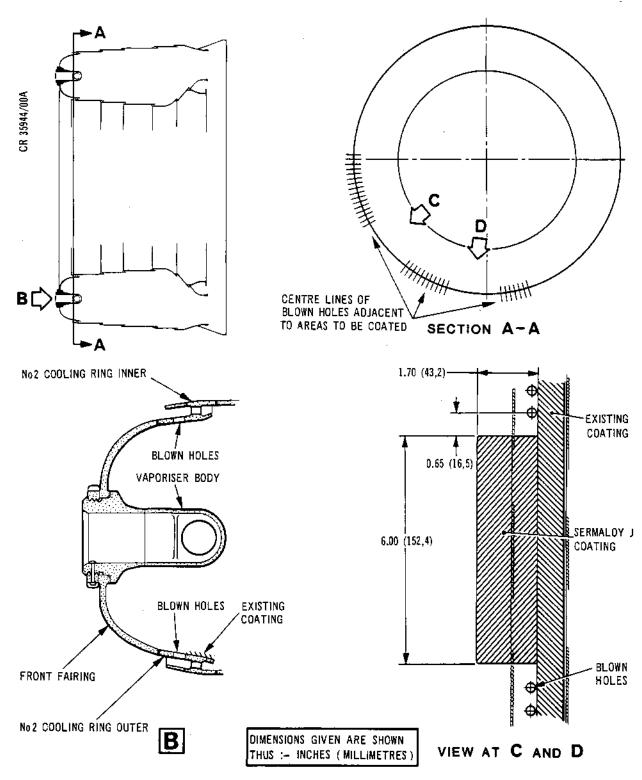
B. Repair Limitations

(1) Combustion chambers with corrosion up to 0.020 in. (0,50 mm) deep may be treated with this repair process.

3. <u>Instructions</u>

- A. Clean
 - (1) Clean the areas to be coated using Process L, as instructed in Chapter 72-09-00 Cleaning.
- B. Inspect
 - (1) Inspect the two areas to be coated, to determine the depth of corrosion. The maximum depth allowable is 0.020 in. (0,50 mm).
- C. Preparation
 - (1) Remove material from the corroded area to a minimum depth of 0.009 in. (0,23 mm). Grinding must not be used. Do not exceed the maximum depth of 0.030 in. (0,76 mm) from the original surface.
- D. Inspect
 - (1) Crack test the affected areas using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.
- E. Apply Sermaloy J Coating
 - (1) Apply Sermaloy J to the two areas indicated in Figure 1, as detailed in Chapter 72-09-05 Repair -Application of Pack Aluminising Touch-Up (Sermaloy J). Observe the following conditions and exceptions:
 - (a) Apply Sermaloy J by spray or brush (spray preferred).
 - (b) During preparation of the areas to be treated, the following operations may be omitted:
 - (i) Dress with 150 grade aluminium oxide.
 - (ii) Polish with Brushing Emery Compound.
 - (iii) Kerosene wash.





Combustion Chamber with Sermaloy J Coating Figure 401

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- (c) Use a test piece to determine the correct thickness of Sermaloy J. The thickness must be 0.0030/0.0015 in. (0,076/0,038 mm). The use of a test piece eliminates the operation to weigh the component.
- (d) Diffusion heat treatment must be for 2 hours at 800 plus/minus 5 deg. C in a constant argon flow.

F. Inspect

- (1) Visually inspect to ensure that the coating has a uniform appearance and is free from chipping and oxidation.
- (2) Crack test the combustion chamber using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.

G. Identify

- (1) Mark the combustion chamber with the following numbers, using electro-chemical or vibro-percussion marking as detailed in Chapter 72-09-00 Repair:
 - (a) The new assembly part number. Refer to Service Bulletin OL.593-72-8822-315 paragraph 3B for the appropriate part number.
 - (b) SAL B.935542 or R12. This number to be marked adjacent to the new assembly number (ref.para.(a)).

H. Final Inspection

(1) Finally inspect the combustion chamber to ensure that the repair has been carried out satisfactorily, and that the combustion chamber is in a serviceable condition.

J. Record

(1) Record the accomplishment of this Repair.



- 4. <u>Special Tools, Fixtures and Equipment</u>

 None.
- 5. <u>Replacement Parts</u>
 None.



COMBUSTION CHAMBER - REPAIR CORRODED FRONT FAIRING AND NO 2 OUTER RING REPAIRED BY PATCHING

MODIFICATION NO. OL. 8852C

THIS REPAIR HAS BEEN CANCELLED



CHAMBER, COMBUSTION, ASSY OF.

LOCAL OR COMPLETE REPLACEMENT OF THERMAL BARRIER COATINGS

REPAIR NO. B935546

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | <u>Part No.</u> |
|------------|-----------|-----------------|
| 72-41-01 | 2 80G | в936939 |
| | | в938157 |
| | | 8938158 |
| | | B938160 |
| | | B938161 |
| | | B938162 |
| | | B938163 |
| | | B938164 |
| | 80H | B938174 |
| | 80J | в938502 |
| | 80K | B512871 |
| | ••• | B512874 |
| | | B512875 |
| | | B512876 |
| | 80M | B514703 |
| | 3011 | B514707 |
| | 80N | B516666 |
| | 0014 | B517451 |
| | 80P | B516672 |
| | our | B517453 |
| | | 0311433 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

There is no limitation to the number of times this repair may be carried out provided that specified dimensions are maintained.

This Repair Instruction is in two parts and covers local or complete replacement of coatings for pre- and post mod. 72-8935 standard Combustion chambers:

Where only local application is required, use only the original coating system from Part 1 or 2 of this Repair Instruction dependant on existing Modification standard.

72-41-01 Repair No. 14

REPAIR

Repair No. 14 Page 401 Jun 30/97



Part 1 - Pre-mod. 72-8935 (IPC 72-41-01, Fig.2, Item 80G, H and J).

Part 2 - Post mod. 72-8935 (IPC 72-41-01, Fig.2, Item 80K, M, N and P).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Mask thermal barrier coating not requiring removal as required. Refer TSD 594 0P.704

2) Abrasive blast to remove the existing coatings as required, using Aluminium Oxide 16/24 mesh grit.

NOTE: It is accepted that complete removal of the existing bond coat is not practical.

Refer Overhaul Manual Chapter 72-09-24 Repair. Refer OMat 184.

- 3) Visually inspect for complete removal of the intermediate and top coatings.
- Locally inspect for cracks.

Refer Overhaul Manual Chapter 72-41-01 Inspection/Check.

At this point it is permissible to embody Mod. 72-8935 by applying coating to the requirements of Part 2 of this Repair Instruction and re-marking as specified in the mod. In this case, it is essential that all existing intermediate and top coatings are removed.

REPAIR 72-41-01 Repair No. 14 Page 402 Jun 30/97



Part 1

5) Mask areas which are not to be coated, using masking plates or bungs. Refer Para.6. TOOLS items 1 to 5.

6) Apply magnesium zirconate coating to areas marked AA. Inspect and re-mask as necessary between coats using operations (a) or (b) as applicable.

Refer Overhaul Manual Chapter 72-09-11 Repair. Refer fig.401, 402 and 403.

NOTE: Ensure all cooling holes, drilled and plunged holes are free from coating.

Use compressed air backing to prevent blockage of effusion holes. Coating may be below minimum thickness around plunged holes.

- (a) If the combustion chamber is split, i.e. inner barrel, outer barrel or head assembly, and the spray nozzle to work distance is a minimum of 8.000(203,20) use the following coats:
 - (i) Bond coat 0.001/0.003(0,03/0,08).
- Refer 0Mat 3/135 or 345.
- (ii) Intermediate coat 0.003/0.005(0,08/0,13).
- Refer OMat 3/137.
- (iii) Top coat 0.006/0.008(0,15/0,20).

Refer OMat 3/136.

- (b) If the combustion chamber is assembled and the spray nozzle to work distance is limited to 4.000(101,60) use the following coats:
 - (i) Bond coat 0.001/0.003(0,03/0,08).

Refer OMat 3/138.

(ii) Intermediate coat 0.003/0.005(0,08/0,13).

Refer OMat 3/139.

(iii) Top coat 0.006/0.008(0,15/0,20).

Refer OMat 3/136.

Part 2

- 7) Mask areas which are not to be coated, using suitable masking tape or blanking plates.
- 8) Apply PYSZ (M-CRALY) coatings over distances marked AH and AJ. Inspect and re-mask as necessary between coats. Use the following operations:

Refer Overhaul Manual Chapter 72-09-11 Repair. Refer fig.404, 405 and 406.

NOTE: Ensure that all cooling holes, drilled and plunged holes are free from coating. Supply compressed air backing to prevent blockage of effusion holes. Coating may be below minimum thickness around plunged holes. Cooling rings to have coating over lip edge as shown on view AK.

(i) Bond coat 0.003/0.005(0,08/0,13).

Refer OMat 345

(ii) Top coat 0.010/0.012(0,25/0,30). Refer OMat 3/185

- Visually inspect for satisfactory application of coating.
- 10) Mark Repair instruction number RI B935546 or R14 adjacent to normal 'assy of' no. using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u>

RR CODE

CHAMBER, COMBUSTION, ASSY OF.

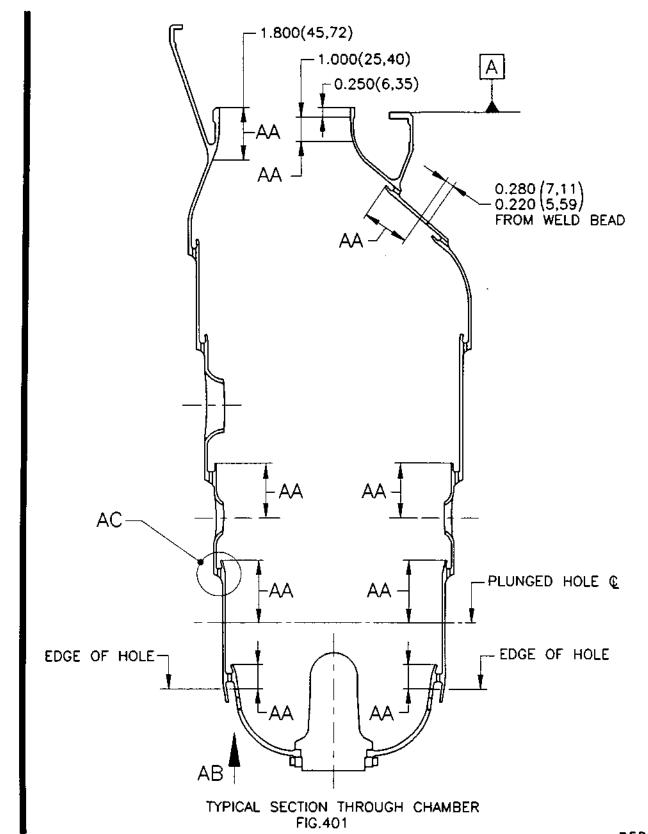
C263 MSRR 7038 QAU

72-41-01 Repair No. 14 Page 404 Jun 30/97 NONE.

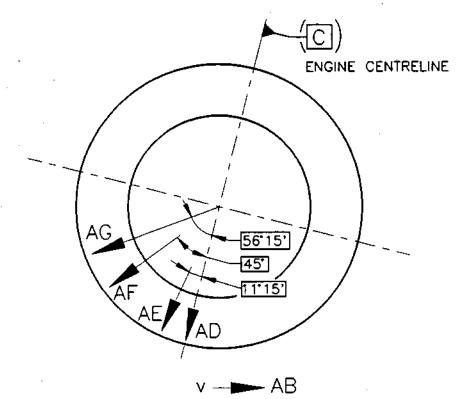


| 6. | <u>DATA</u> | | | |
|----|--|---|-----------------|-----------------------|
| | NONE. | | | |
| 7. | TOOLS | | | |
| | TOOL NUMBER | DESCRIPTION | | <u>ITEM</u> |
| | S3S 15911000 S3S 15912000 S3S 15913000 S3S 15914000 S3S 15915000 | MASKING BUNG Masking bung Masking plate Masking bung Masking bung | | 1 2 3 4 5 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | DESCRIPTION | <u>QUANTITY</u> | <u>ITEM</u> |

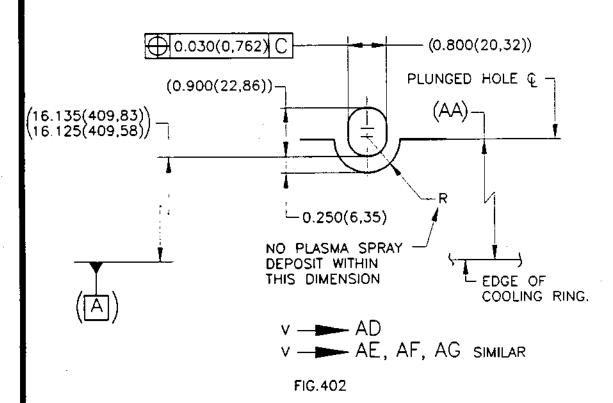




72-41-01 Repair No. 14 Page 406 Jan 31/95 MK.610-14-28 snecma
OVERHAUL



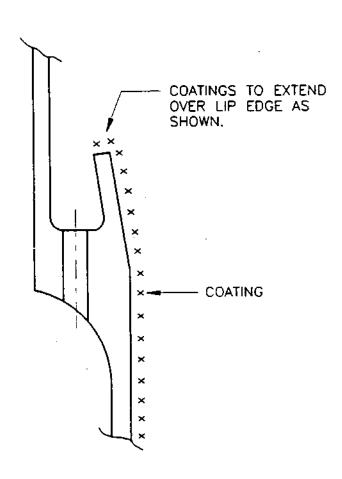
(LOOKING INSIDE ON OUTER BARREL)



REPAIR

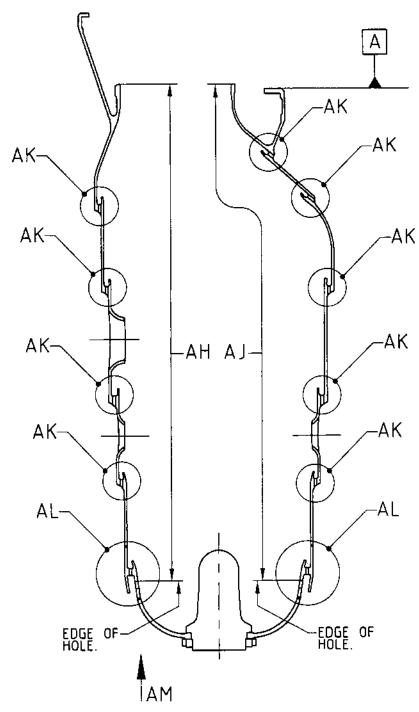
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DETAIL AC (DIAGRAMMATIC) FIG.403

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TYPICAL SECTION THROUGH CHAMBER FIG. 404.

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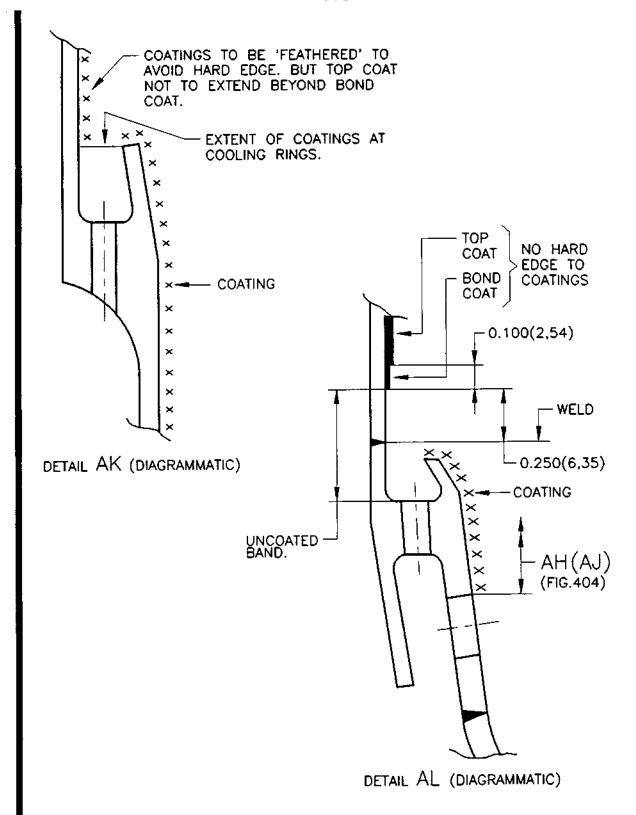
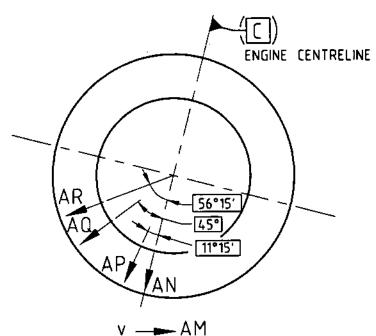
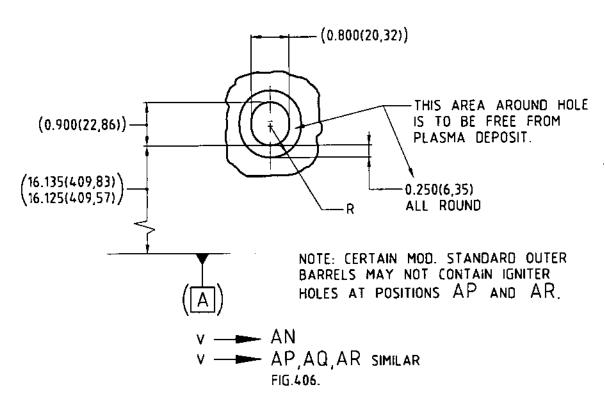


FIG.405

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(LOOKING INSIDE ON OUTER BARREL)



REPAIR **72-41-01** Repair No. 14 Page 411 Jun 1/97



COMBUSTION CHAMBER - REPAIR DAMAGED SECTIONS REPAIRED BY PATCHING

MODIFICATION NO. OL.8838C

1. Effectivity

| I.P.C. | FIG./ITEM | PART NO. |
|----------|-----------|---|
| 72-41-01 | 2 80 | B512876, B513879, B514703, B514707, B516666, B517451, B516672, B517453, B934411, B934482, B934946, B935464, B936628, B936631, B936866, B936868, B936874, B936881, B936883, B936939, B938157, B938161, B938162, B938163, B938164, B938174, B938502 |

Introduction

- A. General.
 - (1) This repair describes the procedure for repairing combustion chamber sections by patching to restore the chamber to a serviceable condition.
 - (2) Dimensions are shown thus; INCHES (MILLIMETERS).

| Section Location Reference Fig.401 | Section Part Number |
|---------------------------------------|------------------------|
| AB-AB | B.495721 |
| A C - A C | B.495732 |
| AD-AD | в.495723 |
| A E - A E | B.495734 |
| AF-AF | В.495725 |
| AG-AG | B.495736 |
| AH-AH | B.495727 |
| Al-Al | в.495739 |
| THIS TABLE TO BE READ | IN CONJUNCTION WITH |
| FIGURE 401. | |

Section Location and Part Numbers Table 401

REPAIR

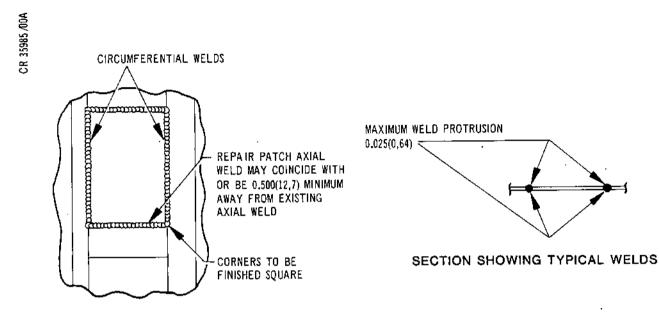
72-41-01 Repair No.15 Page 401 Jun 30/97



- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Refer to Repair No.14 for further spraying information.
- (5) All welds are classified as Group 2.
- B. Repair Limitations.
 - (1) Damaged combustion chamber sections can be repaired provided that the patch dimensions are within the maximum permissible. Ref.Fig.402-406 as applicable.
 - (2) Prior to welding the patch into the combustion chamber aperture, dress any excess weld around the edge of the combustion chamber aperture back flush, thereby restoring the original material thickness.
 - (3) Longitudinal welds must coincide with the original weld lines, or be located a minimum distance of 0.500 in. (12,700 mm) from them; longitudinal weld lines must not encroach a plunged area.
 - (4) All patches are to occupy the full width of the original combustion chamber sections; circumferential welds of the patch and aperture must be at the original weld lines.
 - (5) After completion of welding, the patch must be flush with the existing weld profile; a maximum weld protrusion of 0.025 in. (0,640 mm), (Ref.Figure 401 showing typical weld sections), must be obtained.

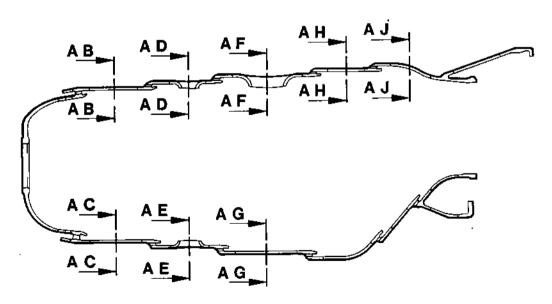
3. Instructions

- A. Inspect and Mark.
 - (1) Visually inspect the combustion chamber for damaged sections.
 - (2) Mark damaged sections.



VIEW ON TYPICAL PATCH LOCATION

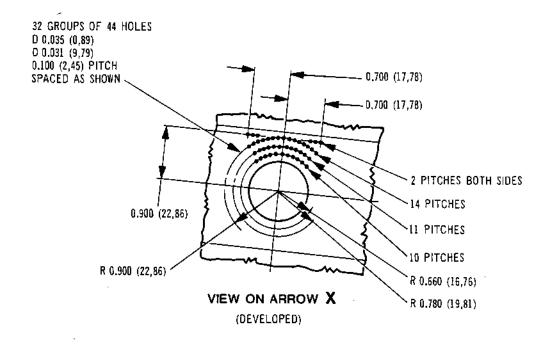
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



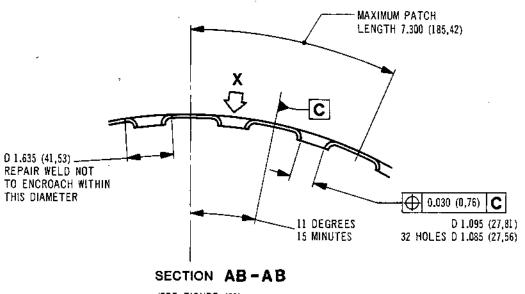
TYPICAL SECTION THROUGH COMBUSTION CHAMBER

Combustion Chamber Location of Items Figure 401

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DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)



(SEE FIGURE 401)

Patch Dimensions and Detail - Section B.495721 Figure 402

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MAXIMUM PATCH LENGTH
4.600 (116,84)

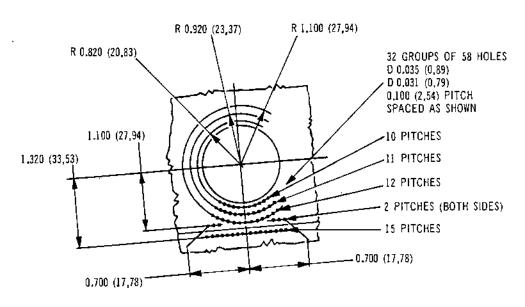
D 2.150 (54,61)

REPAIR WELD MUST NOT ENCROACH WITHIN THIS DIAMETER

MAXIMUM PATCH LENGTH
4.600 (116,84)

D 0.030 (0,76) C

32 HOLES
D 1.360 (34,54)
D 1.350 (34,29)
EQUI-SPACED



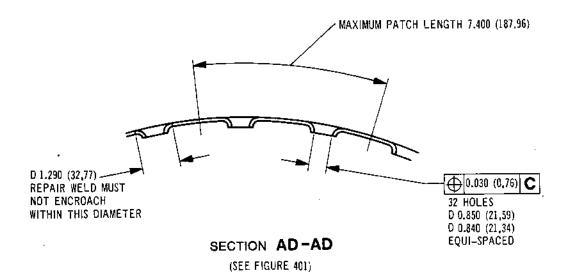
(SEE FIGURE 401)

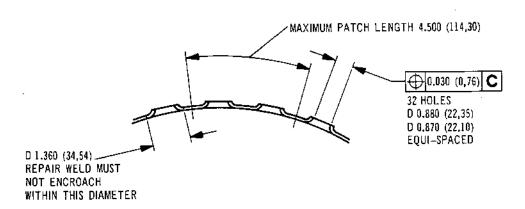
VIEW ON ARROW X
(DEVELOPED)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Patch Dimensions and Detail - Section B.495732 Figure 403

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SECTION AE-AE

(SEE FIGURE 401)

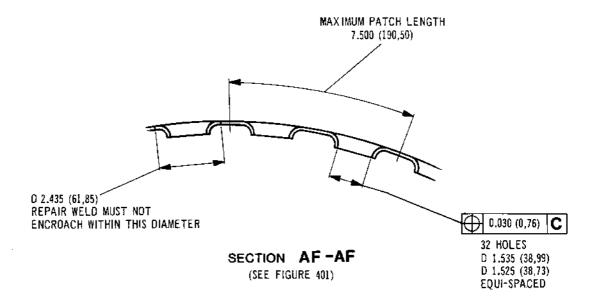
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Patch Dimensions and Detail - Section B.495723 and B.495734
Figure 404
REPA

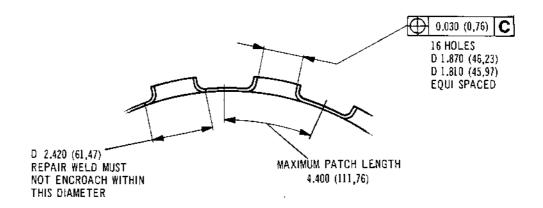
72-41-01 Repair No.15 Page 406 Dec 1/83



CR35987/00A



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

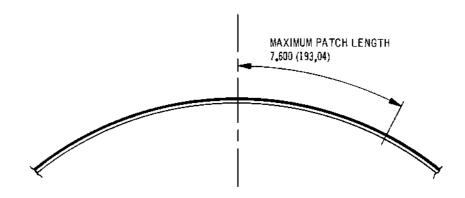


SECTION AG -AG (SEE FIGURE 401)

Patch Dimensions and Detail - Section B.495725 and B.495736 Figure 405

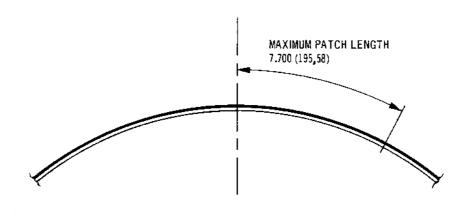
72-41-01 Repair No.15 Page 407 Dec 1/83





SECTION AH -AH

(SEE FIGURE 401)



SECTION AJ-AJ

(SEE FIGURE 401)

DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

Patch Dimensions and Detail - Section B.495727 and B.495739 Figure 406

72-41-01 Repair No.15 Page 408 Dec 1/83

B. Cut Chamber.

- (1) Using conventional hand tools remove defective area of combustion chamber section for the full width of that section, i.e. between the existing circumferential welds.
- (2) Cut a suitable size patch from the appropriate combustion chamber material section (Ref. Table 401) within the repair limitations.

C. Remove Coating.

- (1) Mask the thermal barrier coating not to be removed 0.250 in. (6,35 mm) from the proposed weld line.
- (2) Abrasive grit blast to remove the two top coats of the existing thermal barrier coating within 0.250 in. (6,35 mm) of proposed patch weld line, using 16/24 mesh Aluminium Oxide grit. Refer to 72-09-24, Repair for the relevant procedure.
- (3) Dress to remove bond coat within 0.250 in. (6,35 mm) of proposed patch weld line.

CAUTION: DO NOT REDUCE THE THICKNESS BELOW THAT OF THE SURROUNDING PARENT METAL.

- (4) Inspect to ensure the parent metal gauge thickness.
- (5) Crack detect using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

D. Assemble Patch.

- (1) Ensure that the patch is a good match with the aperture.
- (2) Tack weld the patch in position using inert gas welding and filler rods to MSRR 9500/16.
- (3) Weld the patch in position using inert gas welding and filler rods to MSRR 9500/16.
- (4) Visually inspect for the satisfactory completion of the welding operation.

REPAIR

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- E. Post Weld Heat Treatment.
 - (1) Clean the chamber to remove any traces of marking mediums.
 - (2) Position the chamber in a furnace; heat treat the chamber to a temperature of 800 deg.C. plus/minus 5 deg.C. Soak at this temperature for eight hours, then cool in air.
 - (3) Descale the chamber using the process specified for the component in 72-41-01, Cleaning.
- F. Inspect.

Crack detect using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

- G. Drill.
 - (1) Drill any missing effusion holes around the plunged orifices in sections AB-AB and AC-AC, using the following fixtures:

| <u>Section</u> | <u>Fixture No.</u> |
|----------------|--------------------|
| AB-AB | \$3\$.12433000 |
| | \$38.12457000 |
| A C - A C | \$3\$.12458000 |
| | S3S.12434000 |

Refer to Repair No.9 for inner chamber or Repair No.10 for outer chamber and Fig.402 or 403 for procedure.

- (2) Remove any burrs produced by the drilling operation.
- (3) Check that the correct number of effusion holes have been produced to the correct size and position.
- H. Inspect.

Crack detect using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.



- J. Replace Coating.
 - (1) Mask off areas which are not to be coated.
 - (2) Apply coating; refer to Repair No.14 for the application of the coating and thickness.
 - (3) Inspect and remask as necessary between coats.
 - (4) Inspect to ensure satisfactory application of coatings.
- K. Identify.

Mark SAL.B.935544 or R.15 adjacent to the existing assembly number, using the vibro-percussion marking technique as detailed in Chapter 72-09-00 Repair.

L. Inspect.

Inspect for the satisfactory marking of the component.

M. Finally Inspect.

Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.

4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.



<u>COMBUSTION CHAMBER - REPAIR OF CRACKS</u> BY WELDING AND BLENDING OF LIGHT IMPACT DAMAGE

MODIFICATION NO. OL.8840C

1. Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|-----------|---|
| 72-41-01 | 2 80 | B512876, B513879, B514703, B514707, B516666, B517451, B516672, B517453, B936628, B936631, B936886, B936868, B936939, B938157, B938158, B938160, B938174, B938502 |

2. Introduction

A. General.

- (1) This repair describes the procedure for welding cracks and defects, and for blending light impact damage.
- (2) Dimensions are shown thus; INCHES (MILLIMETERS).
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (5) Ensure the chamber is suitably protected to avoid corrosion and damage, during transit between operations and upon completion of this repair.
- (6) All welds are classified as Group 2.

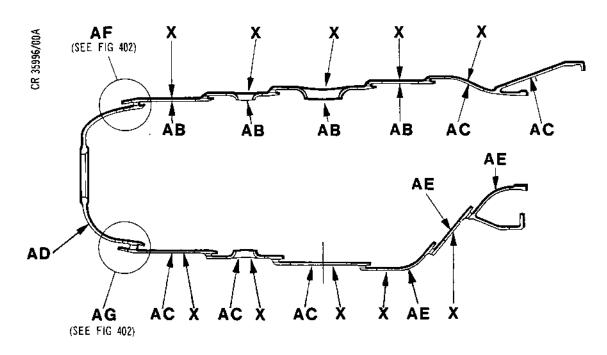
B. Repair Limitations.

(1) Any number of cracks, of any length, running in any direction, may be weld repaired provided such cracks are contained within the inner and outer barrels, and are not in any part of any cooling ring. Cracks around the diffusion holes must not be repaired by this procedure.

REPAIR
72-41-01
Repair No.16
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Jun 30/00



- (2) Any number of defects contained within an existing weld anywhere in the combustion chamber may be weld repaired.
- (3) All defect weld repairs must be confined to areas indicated X in Figure 401, and/or within existing welds.
- (4) External surface damage of a minor nature anywhere on the combustion chamber, excluding the cooling rings and the rear lip of the inner turbine entry duct, may be blended to the minimum resultant section shown in the chart in Figure 401, provided the following conditions are satisfied.
 - (a) The blend has smooth contours in all directions.
 - (b) The blend area is not less than 0.500 in. (12,70 mm), and not greater than 1.000 in. (25,4 mm) in diameter.
 - (c) The blended area does not cross over a weld and that the edge of the blend is at least 0.250 in. (6,35 mm) from any weld.
 - (d) The minimum distance between the edges of any two blended areas is 2,000 in. (50,8 mm).
- (5) Blending of damage to cooling ring leading edges may only be carried out in accordance with Figure 401, with a minimum blend arc of 1.000 in. (25,4 mm).
- (6) Blend only by mechanical means; grinding is not permitted.
- (7) Severe surface mismatch and cracking in effusion hole areas are to be repaired by patching; refer to Repair No.15.
- (8) Distortion of 0.060 in. (1,52 mm) maximum from the average scoop gap may be repaired in accordance with Figure 402.



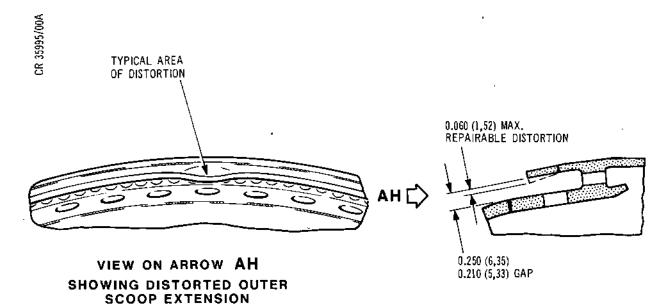
TYPICAL SECTION THROUGH CHAMBER

| COMBUSTION CHAMBER SECTION | AB | AC | AD | AE |
|----------------------------|--------|--------|--------|--------|
| MIN. PERM, SECTION | 0.067 | 0.053 | 0.103 | 0.039 |
| AFTER BLENDING. | (1,70) | (1,35) | (2,62) | (99,0) |

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

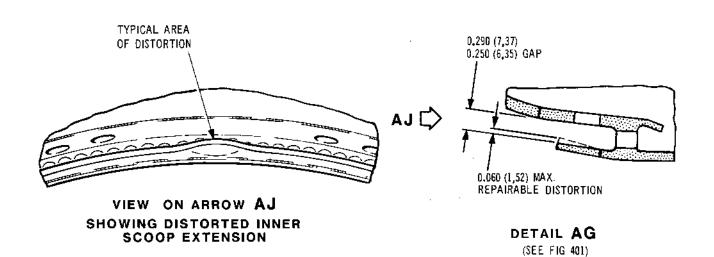
Combustion Chamber - Repair Areas Figure 401





DETAIL AF (SEE FIG 401)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



Repair Details Figure 402

72-41-01 Repair No.16 Page 404 Dec 1/83



3. Instructions

- A. Inspect.
 - (1) Visually inspect the combustion chamber for cracks and/ or defects.
 - (2) Mark up cracks and/or defects to be welded.
 - (3) Identify the cracks which are in a magnesium zirconate thermal barrier coating area.
- B. Weld Cracks.
 - (1) Remove thermal barrier coating (if necessary).

NOTE: Only cracks in thermal barrier coating areas are to be abrasive blasted.

- (a) Mask the thermal barrier coating not to be removed 0.250 in. (6,35 mm) from the crack.
- (b) Abrasive grit blast to remove the two top coats of the existing thermal barrier coating within 0.250 in. (6,35 mm) of the crack, using 16/24 mesh Aluminium Oxide grit. Refer to 72-09-24, Repair for the relevant procedure.
- (c) Dress to remove bond coating within 0.250 in. (6.35 mm) of the crack.

CAUTION: DO NOT REDUCE THE THICKNESS BELOW THAT OF THE SURROUNDING PARENT METAL.

- (d) Inspect to ensure the parent metal gauge thickness is satisfactory.
- (2) Groove.

Groove out crack and/or defect for complete length. Slight surface mismatch due to cracking must be formed to original contour prior to welding.

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(3) Inspect.

Test the grooved area for cracks using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

(4) Weld.

Tungsten inert gas arc weld to repair defect, using filler rod to MSRR 9500/16.

(5) Inspect.

Test the repaired area for cracks using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

- (6) Post Weld Heat Treatment.
 - (a) Clean the chamber to remove any traces of marking mediums.
 - (b) Position the chamber in a furnace; heat treat the chamber to a temperature of 800 deg.C. plus/ minus 5 deg.C. Soak at this temperature for eight hours, then cool in air.
 - (c) Descale the chamber using the process specified for this component in 72-41-01, Cleaning.
- (7) Inspect.

Crack detect using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

- C. Blend Impact Damage.
 - (1) Blend light impact damage within the repair limitations.
 - (2) Surface texture to be 32 micro-inches (0,8 micro-metres) minimum.
 - (3) Inspect.

Crack detect the blended area of the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

> 72-41-01 Repair No.16 Page 4.06 Dec 1/83



- D. Form Inner and Outer Scoops.
 - (1) Inspect.
 - (a) Crack detect the combustion chamber inner and outer scoop extension areas (refer to Figure 402) using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
 - (b) Inspect the inner and outer scoop extensions for distortion. Ensure that distortion does not exceed the repair limitation.
 - (2) Form the distorted area of the scoop extension to front fairing gap dimension. Refer to Figure 402.
 - (3) Inspect.

Crack detect the inner and outer scoop extension areas (refer to Figure 402), using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

- E. Replace Coating.
 - (1) Mask off areas which are not to be coated.
 - (2) Locally respray areas where the thermal barrier coating has been removed.
 - (3) For application of spray coatings refer to Repair No.14.
 - (4) Inspect.

Visually inspect to ensure satisfactory spraying.

F. Identify.

Mark SAL B.935545 or R16 adjacent to the existing part number, using the vibro-percussion marking technique as detailed in Chapter 72-09-00, Repair.

- G. Finally Inspect.
 - (1) Finally inspect the chamber to ensure the repair has been carried out satisfactorily and that the chamber is in a serviceable condition.



- 4. Special Tools, Fixtures and Equipment
- Replacement Parts
 None.



COMBUSTION CHAMBER - REPAIR HEAD ASSEMBLY REPAIRED BY WELDING CRACKS AND PATCHING

MODIFICATION NO. OL.8859C

1. Effectivity

<u>1.P.C.</u> <u>FIG./ITEM</u> <u>PART NO.</u>
72-41-01 2/90 B.500555
B.500649
B.501530

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the head assembly by welding cracks and patching, and replacing the No.2 cooling rings and air scoops.
- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.
- (10) All welds are classified as Group 2.

REPAIR

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- B. Repair Limitations.
 - (1) The maximum length of crack must not be more than 2.0 in. (50 mm).
 - (2) There must not be more than five cracks.
 - (3) The minimum distance between any patch and crack must be 1.0 in. (25 mm).
 - (4) Damage must be contained within patches to maximum dimensions given in Fig. 401.

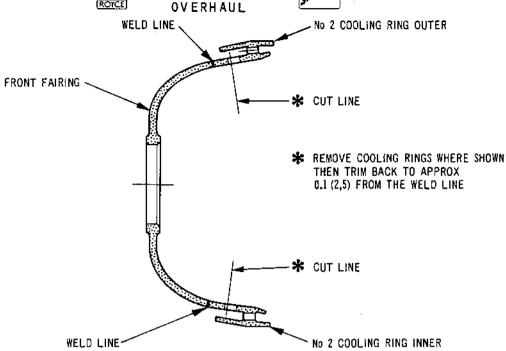
3. <u>Instructions</u>

NOTE: For the procedure to remove the head assembly from the combustion chamber, refer to Repair No.7.

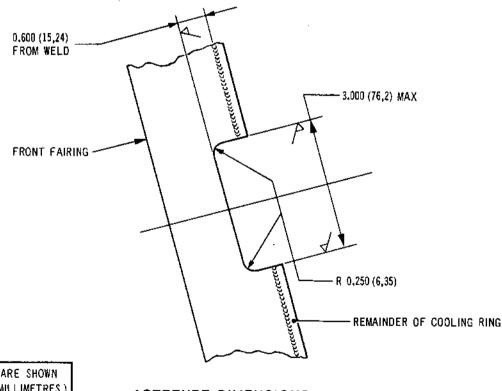
- A. Record Serial Number.
 - (1) Record the head assembly serial number and part number if marked on the No.2 cooling ring.
- B. Machine Head Assembly.
 - (1) Remove pins AS20669 from the head assembly.
 - (2) Locate the head assembly to a vertical centre lathe, and set true.
 - (3) Cut through the No.2 inner and outer cooling rings at the blown holes, then machine back to approximately 0.1 in. (2,5 mm) from the weld line, to allow for later machining (Ref. Fig. 401). Remove burrs and sharp edges.
 - (4) Dress by hand methods only, to remove any weld bead and any Sermaloy J coating within 0.5 in. (13 mm) of the proposed weld lines. Ensure that the diffused layer is removed (approx. 0.001 in. (0,03 mm) deep). Material thinning due to dressing must not exceed 0.005 in. (0,13 mm). Do not use grinding.
- C. Repair Cracks.
 - (1) Visually inspect the front fairing to determine the location and extent of the cracks.

CR 36034/00A





HEAD ASSEMBLY MACHINING



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

APERTURE DIMENSIONS

Combustion Chamber Machining Details Figure 401

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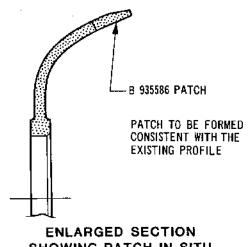


- (2) Form a V-groove both sides of the cracks at 45 deg. inclusive.
- (3) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.
- (4) Weld the cracks from one side only, using tungsten inert gas arc welding with filler rod MSRR 9500/16 and argon backing.
- (5) Dress to remove excessive weld penetration. Do not use grinding.
- (6) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.
- (7) Weld the cracks on the other side, using tungsten inert gas arc welding with filler rod MSRR 9500/16 and argon backing.
- (8) Dress the welds flush both sides. Do not use grinding.
- (9) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.
- D. Repair Corrosion by Patching.
 - (1) Locate the front fairing to a vertical milling machine.
 - (2) Mill the corroded areas to produce apertures within the repair limits (Ref. Fig. 401).
 - (3) Produce patches as required from MSRR 7035 or MSRR 7036 material 0.170 in. (4,32 mm) thick, to suit the contour of the fairing and ensuring a good fit in the aperture (Ref. Fig. 402).
 - (4) Tack-weld the patch in position, then weld complete using inert gas are welding with filler rod MSRR 9500/16, and using a weld sequence to minimise distortion.
 - (5) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-D1 Inspection/Check.

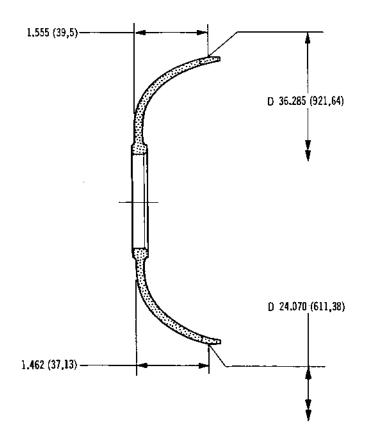
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- (6) Dress weld beads flush on both sides by hand. Do not use grinding. Material thinning due to dressing must not exceed 0.005 in. (0,13 mm).
- (7) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.
- E. Re-form Fairing.
 - (1) Heat treat the fairing to 1150 deg. C plus/minus 5 deg. C for 30 min. in a vacuum or inert atmosphere. Rapid inert gas quench.
 - (2) Restore the correct shape of the fairing using dropstamp tool ref. tool item 1. Check the shape using template ref. tool item 2 (Ref. Fig. 402).
 - (3) Heat treat the fairing to 1150 deg. C plus/minus 5 deg. C for 30 min. in a vacuum or inert atmosphere. Rapid inert gas quench.
 - (4) Restore the correct shape of the fairing using dropstamp tool ref. tool item 1. Check the shape using template ref. tool item 2 (Ref. Fig. 402).
 - (5) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.
- F. Machine Front Fairing.
 - (1) Locate the fairing to a vertical centre lathe and set true.
 - (2) Machine the fairing to length, to obtain the 1.555 in. (39,50 mm) and 1.462 in. (37,13 mm) dimensions (Ref. Fig.403).
 - (3) Crack test the fairing using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.
- G. Assemble Cooling Rings and Deflector Skirts (Scoops).
 - (1) Withdraw from stores replacement No.2 inner cooling ring B.499267PM1, No.2 outer cooling ring B.499266PM1, outer scoop B.500557PM1 and inner scoop B.500557PM1.

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



SHOWING PATCH IN SITU

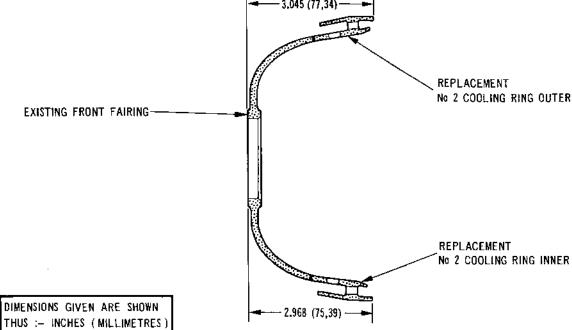


DIMENSIONS AFTER RE-FORMING

Patching and Re-forming Details Figure 402

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Machining and Welding Details Figure 403

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(2) Assemble the inner and outer No.2 cooling rings and scoops to the repaired front fairing, using the method and tooling as instructed in Repair No.7.

H. Heat Treat.

- (1) Heat treat the head assembly to 1075 deg. C plus/minus 5 deg. C for 15 min. in a vacuum or inert atmosphere. Rapid inert gas quench.
- (2) Crack test the head assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.

J. Machine.

- (1) Locate the head assembly to a vertical centre lathe, and set true.
- (2) Turn to produce the 3.045 in. (77,34 mm) and 2.968 in. (75,39 mm) dimensions shown in Fig.403. Remove burrs and sharp edges.
- (3) Crack test the head assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01 Inspection/Check.

K. Apply Coatings.

- (1) Plasma spray the No.2 inner and outer cooling rings as instructed in Repair No.14.
- (2) Replace any areas of Sermaloy J coating removed during preparation. For procedure, refer to Repair No.12, but do not mark the salvage number for Repair No.12 or change the part number.

L. Identify.

- (1) Mark the head assembly with the following numbers, using electro-chemical or vibro-percussion marking as detailed in Chapter 72-09-00 Repair:
 - (a) SAL B499432 or R17. This number to be marked on the front fairing adjacent to any existing part numbers.
 - (b) If the head assembly serial number was previously marked on the No.2 ring, it must now be marked on the front fairing adjacent to the salvage number.

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M. Final Assembly.

(1) For the procedure to attach the inner and outer chambers to the repaired head assembly, refer to Repair No.7.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | Tool No. | <u>Item</u> |
|--------------------|-----------------|------------------|-------------|
| Drop-stamp tool | 1 | S3 S1 4017000 | 1 |
| Template | 1 | \$3 \$1 401 8000 | . 2 |
| Poplacomon+ Parte | | | |

. Replacement Parts

| <u>Description</u> | Quantity | Part No. | IPC Fig | /Item |
|------------------------------|----------|-------------|----------|-------|
| Ring, cooling, No.2 outer | 1 | B.499266PM1 | 72-41-01 | 2/110 |
| Ring, cooling, No.2 inner | 1 | B.499267PM1 | 72-41-01 | 2/120 |
| Scoop, extension, outer | 1 | B.500556PM1 | 72-41-01 | 2/130 |
| Scoop, extension, inner | 1 | B.500557PM1 | 72-41-01 | 2/140 |



COMBUSTION CHAMBER (2BR) - REPAIR RESTORATION OF USED VAPORISER RETAINING NUTS

MODIFICATION NO.OL8860C

1. Effectivity

<u>I.P.C.</u> <u>Fig/Item</u> <u>Part No.</u> 72-41-01 2 30 B.495785

2. Introduction

A. General

- (1) This repair describes the procedure for restoring used vaporiser retaining nuts by removing the peening marks with a tap, and replacing the plating.
- (2) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (3) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (4) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.
- (5) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.
- B. Repair Limitations.

None.

3. Instructions

- A. Remove Plating.
 - (1) Strip off the existing silver plating. For procedure, refer to Chapter 72-09-08 Repair, using stripping solution C.



- B. Remove Peening Marks.
 - (1) Remove the peening marks using a tap (2.0-16UN-2B) inserted at the opposite end of the thread to the peening marks.
- C. Inspect.
 - (1) Inspect for the satisfactory completion of the previous operation.
 - (2) Check the thread minor diameter (1.9523/1.9464 in. (49,588/49,439 mm)).
 - (3) Check the diameter of the rivet holes (0.105/0.098 in. (2,67/2,49 mm)).
 - (4) Crack test the retaining nut using the fluorescent dye penetrant process instructed in Chapter 72-09-00 Inspection/Check. Use process F2A.
- D. Identify.
 - (1) Mark R18 on the outer periphery, using vibro-percussion engraving as instructed in Chapter 72-09-00 Repair.
- E. Silver Plate.
 - (1) Restore the silver plating as instructed in Chapter 72-09-08 Repair, observing the following conditions:

Cleaning solution : A or B

Etching solution : B

Plating thickness : 0.00031/0.00008 in. (0,008/0,002 mm)

·

F. Inspect.

(1) Visually inspect the plating for smoothness, adherence, burns and blisters.



- 4. Special Tools, Fixtures and Equipment
 None.
- 5. Replacement Parts
 None.



CHAMBER, ASSEMBLY, COMBUSTION, REPAIR SERMALOY 'J' COATING ON HEAD ASSEMBLY

1. EFFECTIVITY

| I.P.C. | <u>Fig/Item</u> | Part No. |
|----------|-----------------|--------------------|
| 72-41-01 | 2 10AA | B518175 |
| | 10N | в938173 |
| | 10R | в512865 |
| | 108 | в513927 |
| | 10Т | B514702 B514706 |
| | 10ប | B516665 B517450 |
| | 10 v | B516671 B517452 |
| | 10W | B518172 B518176 |
| | 10X | B518174 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process shall be achieved without deviation. Where a need to deviate is considered necessary reference shall be made to the Repair Authority for agreement.

Maximum permitted depth of corrosion is 0.050 (1,27).

Minimum distance between areas of corrosion is 2.500 (63,50).

2. GENERAL

Unless otherwise specified Drawing practice and tolerance interpretation to ISO1101 (JES160)

Dimensions in Inches (Millimetres)
Tolerance on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees

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Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to IS01302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to IS02553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- 1) Remove the 16 off vaporisers as instructed.
- Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the Salvage number for Repair No.8.
- 2) Clean the areas to be coated.
- Refer to Overhaul Manual Chapter 72-09-00 Cleaning using process L.
- 3) Visually and dimensionally inspect any corroded areas to determine depth of corrosion.
- Refer to Repair Limitations.
- 4) Hand dress to remove material from corroded areas to a minimum of 0.009 (0,23).

 Do not exceed the maximum depth of 0.060 (1,52) from the original surface.

Refer to Overhaul Manual Chapter 72-09-22 Repair. NOTE: Grinding must not be used.

- 5) Locally dye penetrant inspect dressed locations.
- Refer to TSD 594 OP.213.
- 6) Prepare areas for coating.

Refer to Overhaul Manual Chapter 72-09-05 Repair Para.2.C.
NOTE: During preparation the following operations

NOTE: During preparation the following operations may be omitted:

- i) Dress with 150 grade aluminium oxide.
- ii) Polish with Brushing Emery Compound.
- iii) Kerosene wash.

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| 7) | Apply a Sermaloy 'J' coating |
|----|--------------------------------|
| | to the prepared areas to a |
| | thickness of 0.0015 (0,038)/ |
| | 0.003 (0,076) by spray or |
| | brush (spray preferred). |
| | Overspray into the blown holes |
| | is acceptable. |
| | NOTE: The Sermaloy 'J' coating |
| | is to overlap the existing |
| | magnesium zirconate coating by |
| | 0.100/0.200 (2,54/5,08). |

Refer to Overhaul Manual Chapter 72-09-05 Repair Para.2.D. Refer to Fig. 401.

NOTE: A test piece is to be used to determine the correct thickness of Sermaloy 'J' coating applied, this eliminates the operation to weigh the component.

Diffusion heat treat the coating.

Heat treat for 2 hours at $800^{\circ}\text{C} \pm 5^{\circ}\text{C}$ in constant Argon flow.

- 9) Visually inspect to ensure that the coating has a uniform appearance and is free from chipping and oxidation.
- Dye penetrant inspect component.

Refer to TSD 594 OP.213.

11) Assemble the 16 off vaporisers as instructed.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the Salvage number for Repair No.8.

12) Mark Repair Instruction number RI B935591 or R19 on component, adjacent to normal assembly number, using the vibro-percussion engraving technique.

Refer to Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

| COMPONENT | MATERIAL | <u>RR CODE</u> |
|-------------------------------|--------------------------------|----------------|
| CHAMBER, ASSEMBLY, COMBUSTION | C263 MSRR 7038 MSRR 7036 | Q A U Q A R |

6. DATA

None



7. <u>TOOLS</u>

None

8. REPLACEMENT PARTS

PART NUMBER

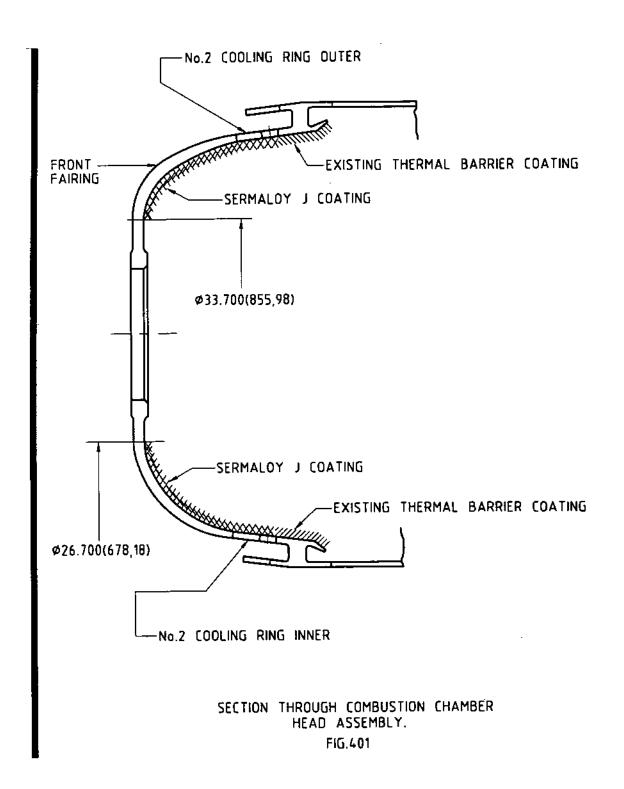
DESCRIPTION

QUANTITY

ITEM

None

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COMBUSTION CHAMBER (2BR) - REPAIR REPLACEMENT OF COMPLETE INNER AND/OR OUTER CHAMBER ASSEMBLIES

MODIFICATION NO. OL.8884C

1. Effectivity

| I.P.C. | <u>Fig.</u> | /Item | <u>Part Number</u> |
|----------|-------------|-------|--------------------|
| 72-41-01 | 2 | 10N | в938173 |
| | 2 | 10P | B938501 |
| | 2 | 10R | B512858 |
| | | | в512863 |
| | | | B512864 |
| | | | B512865 |

2. Introduction

A. General.

- (1) This repair describes the procedure for replacing complete inner and/or outer chamber assemblies with new complete assemblies.
- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) After welding, ovality and shrinkage on items indicated Z (Ref.Fig.401) may be up to minus 0.240 in. (6,096 mm) on diameter.

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- (10) The igniter hole positions (Ref.Fig.408) may be plus/minus 0.050 in. (1,27 mm) from the horizontal centre line of the combustion chamber after welding.
- (11) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.
- (12) All welds are classified as Group 2.
- B. Repair Limitations.
 - (1) Refer to Table 401 for Salvage number identification.

| Salvage No. | Repair | Replacement Parts |
|-------------|-----------------------------|-------------------|
| в507640 | inner and outer chambers | B507009, B507100 |
| B507641 | inner chamber | B507009 |
| B507642 | outer chamber | B507010 |

Salvage Number Identification Table 401

3. Instructions

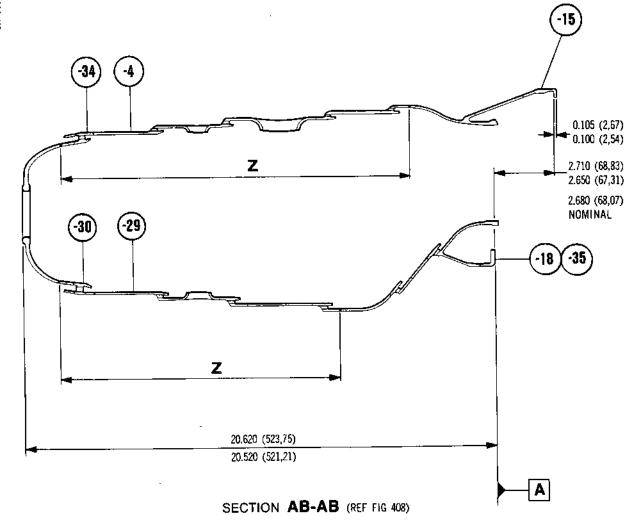
- A. Remove Shank Nuts, Vaporisers and Locating Pins.
 - (1) Remove the vaporisers as instructed in Chapter 72-41-01 Repair No.8. Do not mark the Salvage number for Repair No.8.
 - (2) Remove the 32 vaporiser locating pins, taking care not to damage the holes.
 - (3) Remove the self-locking shank nuts AS.27871 from the rear flange (Ref. dash items 18 and 35, Fig.401).
 Care must be taken not to damage the flange. Refer to 72-09-00, Repair, for removal procedure.
 - (4) Inspect to ensure satisfactory removal of shank nuts.

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DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Combustion Chamber Details Figure 401

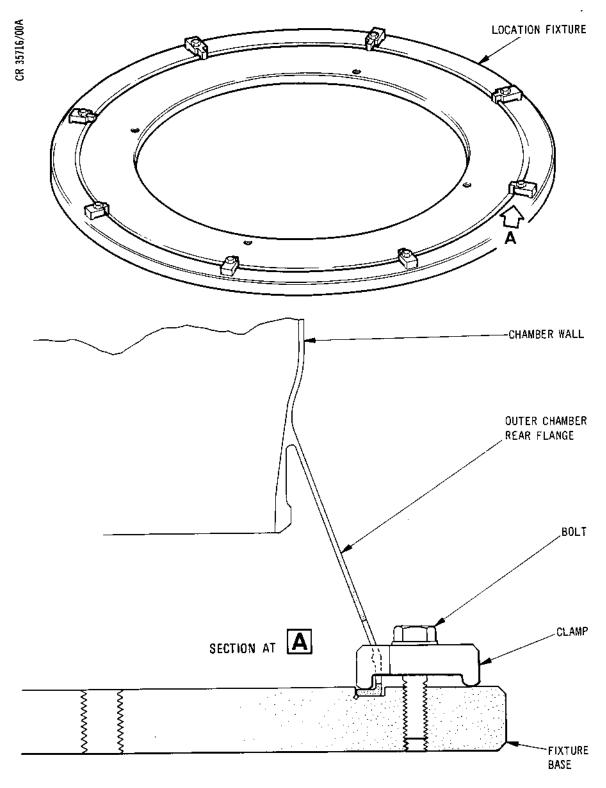
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B. Replace Inner Chamber Assembly.

NOTE: If the inner chamber is not to be replaced, continue the instructions at paragraph 3C.

- (1) Mark-off.
 - (a) Record the inner chamber assembly serial number, which is marked on the rear flange (Ref. dash item 18, Fig. 401).
 - (b) Locate the combustion chamber assembly on a surface table on the rear outer flange.
 - (c) Mark a line circumferentially around the inner chamber section (Ref. dash item 29, Fig.401), 0.20 in. (5 mm) below the weld line with the No.2 cooling ring (Ref. dash item 30, Fig.401), using a suitable marking medium, i.e. a black magic Marker or Spectra Blue.
- (2) Cut Chamber.
 - (a) Locate the chamber in holding fixture ref. tool item 1 (Ref.Fig.402), using packing to support the inner chamber. Separate the chamber by cutting circumferentially around the line marked using an argon torch and anti-spatter guard, ref. tool item 2, or a mechanical cutter.
 - (b) Clean to remove spatter bead, produced by plasma cutting, from outer chamber/head assembly. Care must be taken to ensure no thinning of parent metal occurs.
 - (c) Inspect outer chamber/head assembly for excessive distortion.
 - (d) Remove distortion if necessary using conventional hand tools.
 - (e) Inspect for satisfactory separation of sections.

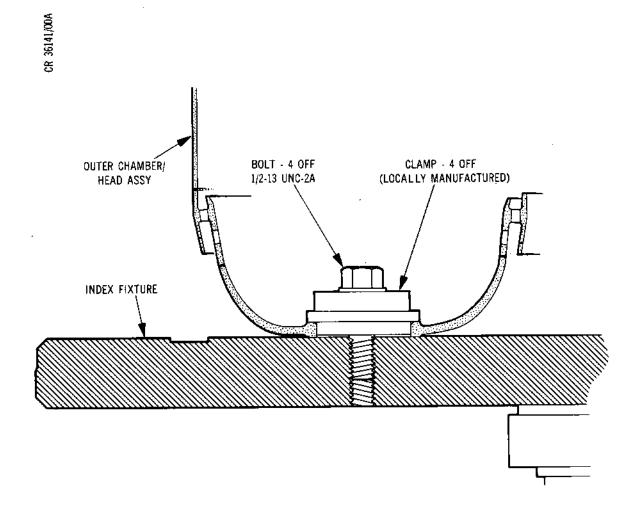


Holding Fixture Ref. Tool Item 1 Figure 402

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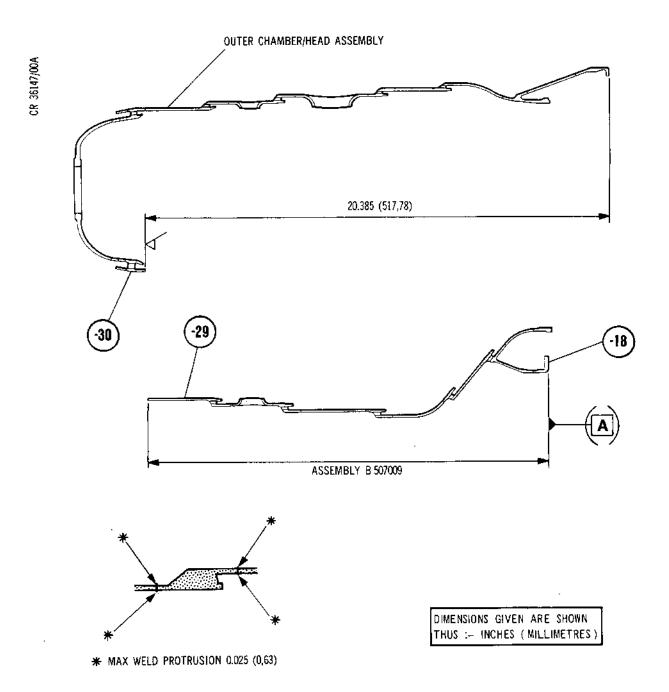
- (3) Machine Outer Chamber/Head Assembly.
 - (a) Remove the clamp bolt, clamp and spacer at four locations on index fixture ref. tool item 3, and store for future use (Ref.Fig.403).
 - (b) Locate outer chamber/head assembly to fixture, using a clamp of local manufacture and locate fixture/component assembly to a vertical centre lathe. Turn to produce the 20.385 in. (517,78 mm) dimension (Ref.Fig.404). Remove burrs.
 - (c) Inspect to ensure 20.385 in. (517,78 mm) dimension has been achieved satisfactorily.
 - (d) Crack test the outer chamber head/assembly using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- (4) Inspect Sermaloy J Coating.
 - (a) Inspect the Sermaloy J coating on the front fairing for damage.
 - (b) If necessary, repair damage using the procedure specified in Chapter 72-41-01, Repair No.19. Do not mark the Salvage number for Repair No.19.
- (5) Machine Inner Chamber.
 - (a) Measure the 20.385 in. (517,78 mm) dimension (Ref.Fig.404) accurately, add 0.015 in. (0,38 mm) weld allowance and record total.
 - (b) Subtract from the dimension recorded at para.(a) the 2.680 in. (68,07 mm) dimension from the inside face of the rear outer flange to outside face of the rear inner flange (Ref.Fig.401) and record.
 - (c) Subtract from the dimension recorded at para.(b) the 0.1025 in. (2,60 mm) rear outer flange thickness dimension (Ref. Fig. 401) and record.



Index Fixture Ref. Tool Item 3
Figure 403



- (d) Withdraw from stores a new inner chamber assembly B507009.
- (e) Locate inner chamber to fixture ref. tool item 4 (Ref.Fig.405), and locate chamber/fixture assembly to a vertical centre lathe. Set true.
- (f) Machine the inner chamber to an overall height as recorded at para.(c) from the datum A flange face (Ref.Fig.404). Remove burrs.
- (g) Inspect for satisfactory machining.
- (h) Crack test the inner chamber, using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection.Check.
- (6) Plasma Spray Inner Chamber.
 - (a) Plasma spray the inner chamber assembly as instructed in Chapter 72-41-01, Repair No.14. Do not mark the Salvage number for Repair No.14.
- (7) Attach Inner Chamber to Outer Chamber/Head Assembly.
 - NOTE: It may be necessary to expand the inner chamber to obtain the correct match with the head assembly (Ref. tool items 5 to 8 and Fig. 406).
 - (a) Remove the existing vaporiser setting pads from fixture ref. tool item 9, and store in container ref. tool item 10. Attach items in adapter set ref. tool item 11 (Ref.Fig.407) to fixture.
 - (b) Polish the mating surface using clean fine grade Scotchbrite and locally degrease with Genklene.

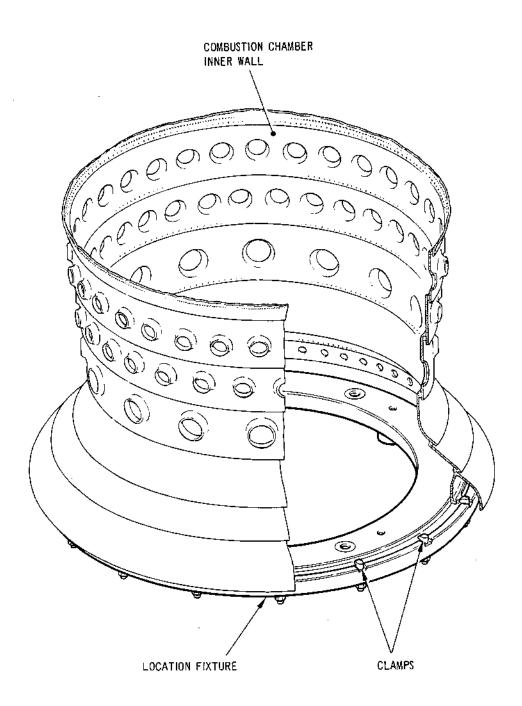


TYPICAL WELDS AT ALL COOLING RINGS

Machining Details Figure 404

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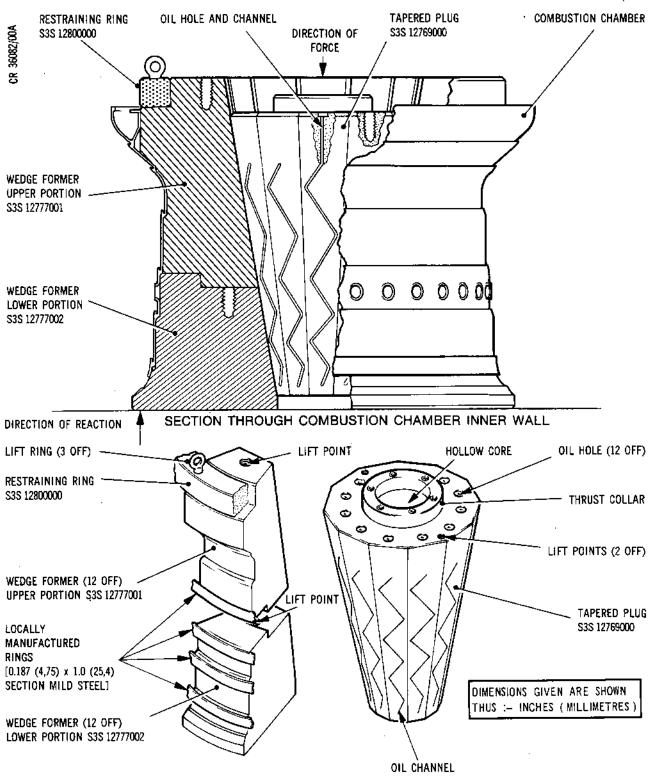
Holding Fixture Ref. Tool Item 4 Figure 405

Page 410 Jun 1/88 (c) Assemble the inner chamber to the outer chamber/ head assembly using welding fixture ref. tool item 9 with adapter set ref. tool item 11 fitted (Ref.Fig.407). Ensure the existing holes are in the correct position as shown at Fig.408. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown at Fig.409.

The inner chamber must be located in the NOTE: fixture using the four dowel holes (one offset at AC Ref.Fig.408). The outer chamber/head assembly is located in the fixture using the fixture locating pin (Ref. section A, Fig. 407), engaged in the 0.900 in. (22,860 mm) diameter hole. It may be necessary to shim under the vaporiser location positions and wedge up the inner head assembly to overcome any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 in. (0,762 mm) at any one position and care must be taken not to damage the head assembly outer skin.

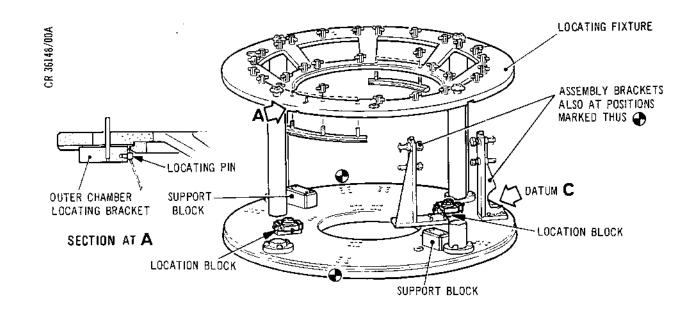
- (d) Tackweld, diametrically opposite, the inner chamber to the outer chamber/head assembly using argon backing stand ref. tool item 12 and argon backing head ref. tool item 13 (Ref.Fig.410); refer to para.6, Process A for welding data.
- (e) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the inner chamber from the outer chamber/ head assembly and after dressing and cleaning, the tackwelding procedure repeated.
- (f) Remove the combustion chamber assembly from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 12 and argon backing head ref. tool item 13 (Ref.Fig.410), autoweld the inner chamber to the outer chamber/ head assembly.

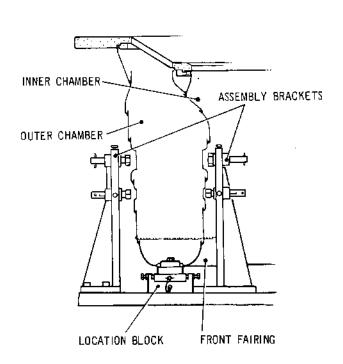




Expanding Equipment - Inner Chamber Ref. Tool Items 5 to 8 Figure 406

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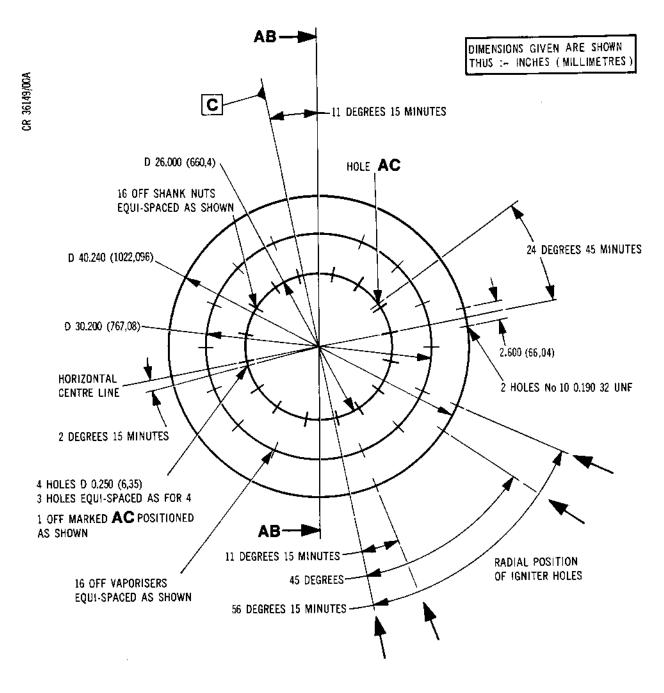
Welding Fixture Ref. Tools Items 9 and 11 Figure 407

72-41-01 Repair No.20 Page 413 Jun 1/88

- (g) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig.409. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the inner chamber must be removed from the outer chamber/ head assembly by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (h) Inspect to ensure the 2.710/2.650 in. (68,33/67,82 mm) and 20.620/20.520 in. (523,75/521,21 mm) dimensions (Ref.Fig.401) have been achieved, and that the welding has been carried out satisfactorily.
- (j) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- C. Replace Outer Chamber Assembly.

NOTE: If the outer chamber assembly is not to be replaced, continue the instructions at paragraph 3D.

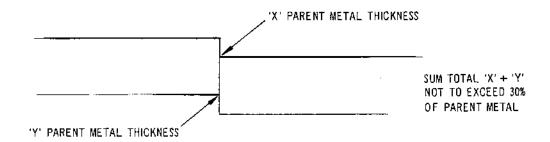
- (1) Mark-off.
 - (a) Record the outer chamber serial number, which is marked on the rear flange (Ref. dash item 15, Fig. 401).
 - (b) Locate the combustion chamber assembly on a surface table on the rear outer flange.
 - (c) Mark a line circumferentially around the outer chamber section (Ref. dash item 4, Fig.401), 0.20 in. (5 mm) below the weld line with the No.2 cooling ring (Ref. dash item 34, Fig.401) using a suitable marking medium, i.e. a black Magic Marker or Spectra Blue.



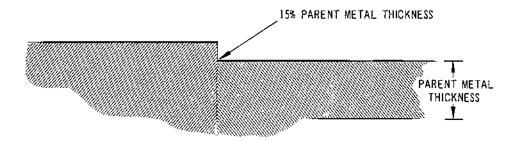
DIAGRAMMATIC VIEW LOOKING FORWARD SHOWING ALIGNMENT OF EXISTING HOLES

Alignment Diagram Figure 408

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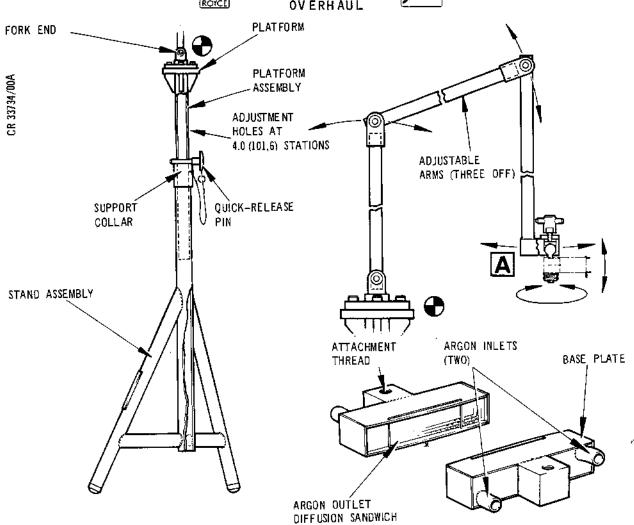
DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS



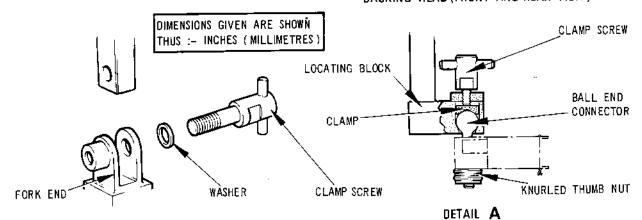
STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

Acceptable Mismatch Figure 409





BACKING HEAD (FRONT AND REAR VIEW)



TYPICAL FORK END DETAIL

SHOWING BACKING HEAD ATTACHMENT

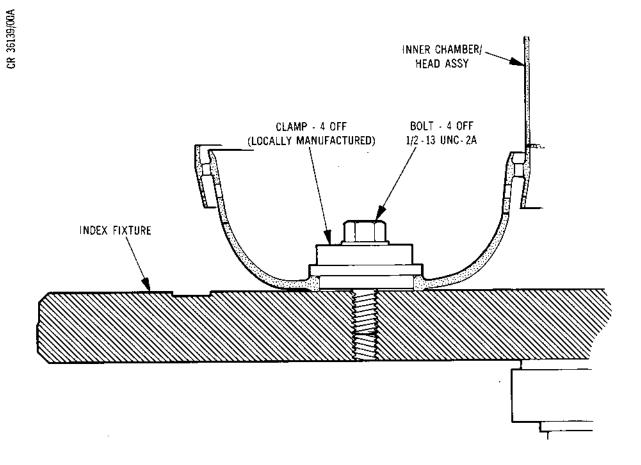
Argon Backing Stand and Head Ref. Tool Items 12 and 13 Figure 410

> 72-41-01 Repair No.20 Page 417 Jun 1/88



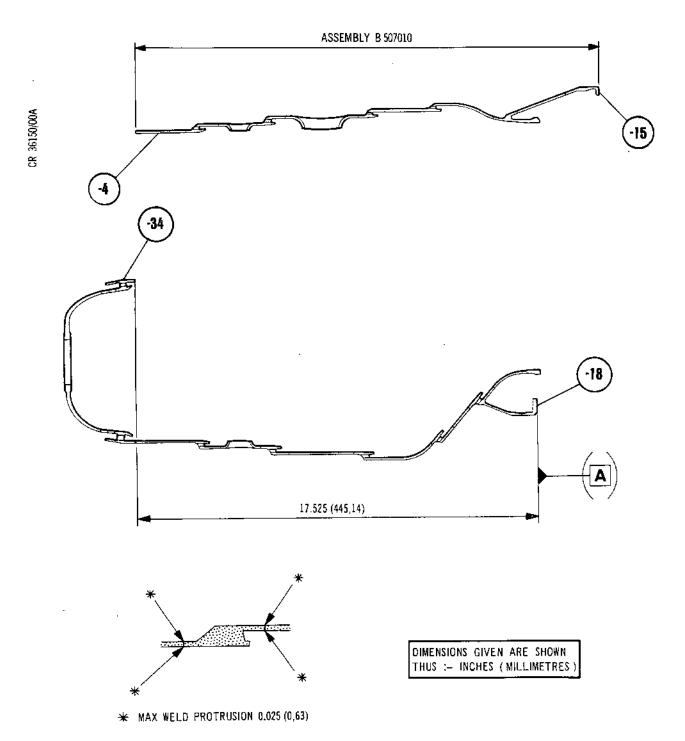
(2) Cut Chamber.

- (a) Locate the chamber in holding fixture ref. tool item 1 (Ref.Fig.402), using packing to support the inner chamber. Separate the chamber by plasma cutting circumferentially around the line marked using an argon torch and anti-spatter quard, ref. tool item 2 or a mechanical cutter.
- (b) Clean to remove spatter bead, produced by plasma cutting, from inner chamber/head assembly. Care must be taken to ensure no thinning of parent metal occurs.
- (c) Inspect inner chamber/head assembly for excessive distortion.
- (d) Remove distortion if necessary using conventional hand tools.
- (e) Inspect for satisfactory separation of sections.
- (3) Machine Inner Chamber/Head Assembly.
 - (a) Remove the clamp bolt, clamp and spacer at four locations on index fixture ref. tool item 3, and store for future use (Ref. Fig. 411).
 - (b) Locate inner chamber/head assembly to fixture, using a clamp of local manufacture and locate fixture/component assembly to a vertical centre lathe. Turn to produce the 17.525 in. (445,14 mm) dimension (Ref.Fig.412). Remove burrs.
 - (c) Inspect to ensure the 17.525 in. (445,14 mm) dimension has been achieved satisfactorily.
 - (d) Crack test the inner chamber/head assembly using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.



Index Fixture Ref. Tool Item 3
Figure 411





TYPICAL WELDS AT ALL COOLING RINGS

Machining Details Figure 412

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- (4) Inspect Sermaloy J Coating.
 - NOTE: If the inner chamber assembly has been replaced, this inspection has already been done, and the instructions can be continued at paragraph C(5).
 - (a) Inspect the Sermaloy J coating on the front fairing for damage.
 - (b) If necessary, repair damage using the procedure specified in Chapter 71-41-01 Repair No.19. Do not mark the Salvage number for Repair No.19.
- (5) Machine Outer Chamber.
 - (a) Measure the 17.525 in. (445,14 mm) dimension (Ref.Fig.412) accurately, add 0.015 in. (0,38 mm) weld allowance and record total.
 - (b) Add to the dimension recorded at para.(a) the 2.680 in. (68,07 mm) dimension from the inside face of the rear outer flange to outside face of the rear inner flange (Ref.Fig.401) and record.
 - (c) Add to the dimension recorded at para.(b) the 0.1025 in. (2,60 mm) rear outer flange thickness dimension (Ref.Fig.401) and record.
 - (d) Withdraw from stores a new outer chamber assembly B507010.
 - (e) Locate outer chamber to fixture ref. tool item 1 (Ref.Fig.402), and locate chamber/fixture assembly to a vertical centre lathe. Set true.
 - (f) Machine the outer chamber to an overall height as recorded at para.(c) from the rear outer flange. Remove burrs.
 - (g) Inspect for satisfactory machining.
 - (h) Crack test the inner chamber, using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

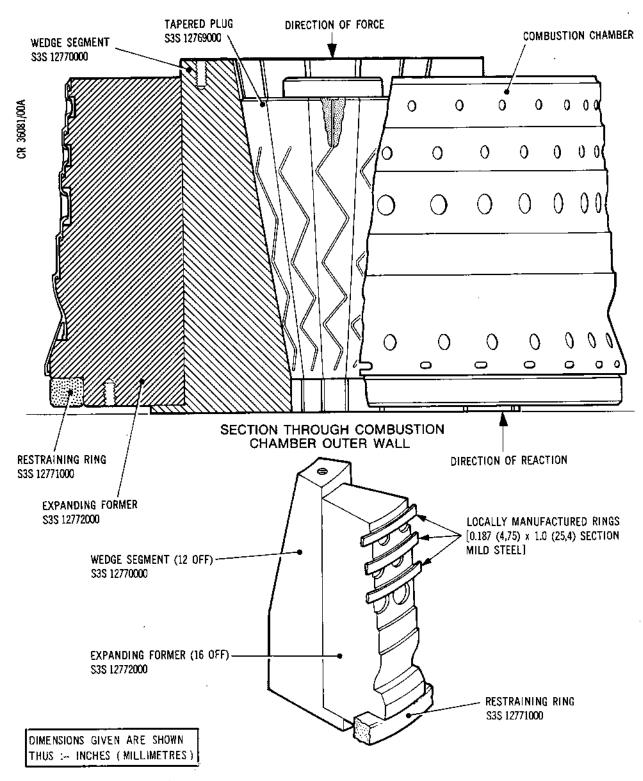


- (6) Plasma Spray Outer Chamber.
 - (a) Plasma spray the outer chamber assembly as instructed in Chapter 72-41-01 Repair No.14. Do not mark the Salvage number for Repair No.14.
- (7) Attach Outer Chamber to Inner Chamber/Head Assembly.
 - NOTE: It may be necessary to expand the outer chamber to obtain the correct match with the head assembly (Ref. tool items 5, 14, 15, 16 and Fig. 413).
 - (a) Remove the existing vaporiser seating pads from fixture ref. tool item 9 and store in container ref. tool item 10. Attach items in adapter set ref. tool item 11 (Ref.Fig.407) to fixture.
 - (b) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (c) Assemble the outer chamber to the inner chamber/ head assembly using welding fixture ref. tool item 12 with adapter set ref. tool item 13 fitted (Ref.Fig.407). Ensure the existing holes are in the correct position as shown at Fig.408. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown at Fig.409.

NOTE: The inner chamber/head assembly must be located in the fixture using the four dowel holes (one offset at AC Ref.Fig.408). The outer chamber is located in the fixture using the fixture locating pin (Ref. section A, Fig.407), engaged in the 0.900 in. (22,860 mm) diameter hole.

It may be necessary to shim under the vaporiser location positions and wedge up the outer head assembly to overcome any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 in. (0,762 mm) at any one position and care must be taken not to damage the head assembly outer skin.





Expanding Equipment - Outer Chamber Ref. Tool Items 5, 14, 15 and 16 Figure 413

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- (d) Tackweld, diametrically opposite, the outer chamber to the inner chamber/head assembly using argon backing stand ref. tool item 12 and argon backing head ref. tool item 13 (Ref.Fig.410); refer to para.6, Process B for welding data.
- (e) Check to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the outer chamber from the inner chamber/ head assembly and after dressing and cleaning, the tackwelding procedure repeated.
- (f) Remove the combustion chamber assembly from the fixture and clamp to a welding table. Using argon backing stand ref. tool item 12 and argon backing head ref. tool item 13 (Ref.Fig.410), autoweld the outer chamber to the inner chamber/ head assembly.
- (g) Check that the weld protrusion is complete and does not exceed the permissible amount shown at Fig.409. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the outer chamber must be removed from the inner chamber/ head assembly by plasma cutting and machining as detailed previously, and the whole procedure repeated.
- (h) Inspect to ensure the 2.710/2.650 in. (68,33 67,82 mm) dimension (Ref.Fig.401) has been achieved and that the welding has been carried out satisfactorily.
- (j) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

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D. Heat Treat.

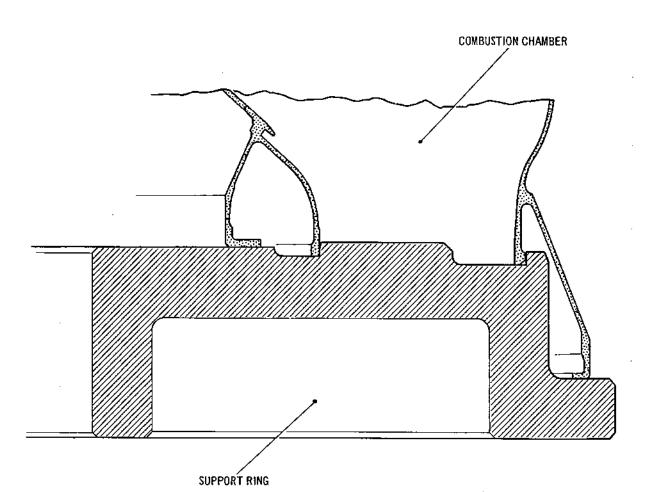
- (1) Locate chamber to heat treatment support ring ref. tool item 17 (Ref.Fig.414) and place component/ fixture assembly in a vacuum/argon furnace.
- (2) Heat treat chamber to 800 deg.C. plus/minus 5 deg.C. for 8 hours. Rapid inert gas quench.
- (3) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.

E. True-up Chamber.

- (1) Generally true-up the chamber, using standard shop tools to achieve the tolerances shown at Fig. 415.
- (2) Crack test the chamber using the fluorescent dye penetrant process specified for this component in 72-41-01, Inspection/Check.
- F. Assemble Vaporisers and Locating Pins.
 - (1) Using a suitable freezing agent, shrink-fit the 32 vaporiser locating pins into the front fairing; refer to Chapter 72-41-01 Repair No.8 for installation details.
 - (2) Assemble the 16 vaporisers as instructed in Chapter 72-41~01 Repair No.8. Do not mark the Salvage number for Repair No.8.

G. Install Shank Nuts.

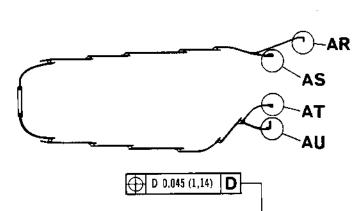
- (1) Locate the shank nuts (Ref. dash item 35, Fig.401) progressively to rear flange (Ref. dash item 18, Fig.401), and swage over into countersunk holes, using swaging tool ref. tool item 18; refer to Chapter 72-09-00 Repair, for installation procedure.
- (2) Inspect to ensure satisfactory installation of shank nuts.

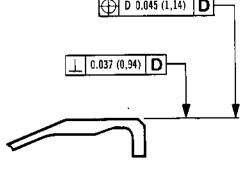


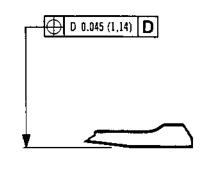
Heat Treatment Support Ring Ref. Tool Item 17 Figure 414

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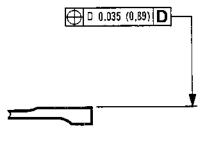




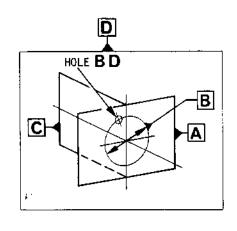


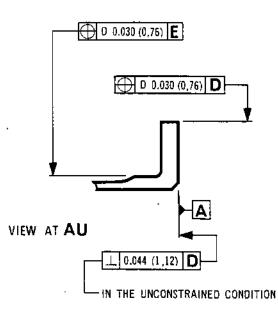


VIEW AT AR



VIEW AT AT





DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Tolerance Details Figure 415

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H. Inspect.

(1) Test the chamber for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-41-01, Inspection/Check.

J. Identify.

- (1) Mark the combustion chamber assembly with the following numbers, using electro-chemical or vibro-percussion marking as detailed in Chapter 72-09-00, Repair:
 - (a) Salvage number as appropriate (Refer to Table 401).
 - (b) Serial numbers as previously recorded. The inner chamber assembly (B507009) serial number is marked on the inner flange (Ref. dash item 18, Fig.401). The outer chamber assembly (B507010) serial number is marked on the outer flange (Ref. dash item 15, Fig.401).

K. Final Inspection.

- (1) Finally inspect the chamber to ensure that the repair has been carried out satisfactorily and that the combustion chamber is in a serviceable condition.
- (2) Generally clean the combustion chamber to remove grease and foreign bodies, and place in container ref. tool item 19.



4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u>Item</u> | <u>Fig.No.</u> |
|---------------------|----------|-----------------------------|-------------|----------------|
| Holding Fixture | 1 | \$38.15231000 | 1 | 402 |
| Anti-spatter Guard | 1 | \$38.15919000 | 2 | _ |
| Index Fixture | 1 | \$3\$.15924000 | 3 | 403 |
| Holding Fixture | 1 | S3S.12437000 | 4 | 405 |
| Tapered Plug | 1 | S3S.12769000 | 5 | 406 |
| Wedge Former | 12 | S3S.12777001 | 6 | 406 |
| Wedge Former | 12 | S3S.12777002 | 7 | 406 |
| Restraining Ring | 1 | S3S.12800000 | 8 | 406 |
| Welding Fixture | 1 | S3S.12431000 | 9 | 407 |
| Container | 1 | S3S.15936000 | 10 | 407 |
| Adapter Set | 1 | \$3\$.15910000 | 11 | 407 |
| Argon Backing Stand | 1 | \$35 ₋₁₂₄₄₅₀₀₀ | 12 | 410 |
| Argon Backing Head | 1 | \$3\$.12446000 | 13 | 410 |
| Wedge Segment | 12 | S3S.12770000 | 14 | 413 |
| Expanding Former | 16 | \$38.12772000 | 15 | 413 |
| Restraining Ring | 1 | \$35.12771000 | 16 | 413 |
| Heat Treatment | 1 | \$3\$ ₋ 12439000 | 17 | 414 |
| Support Ring | | | | |
| Swaging Tool | 1 | S3S.12440000 | 18 | - |
| Container | 1 | S3S.11698000 | 19 | - |

5. <u>Replacement Parts</u>

| <u>Description</u> | <u>Quantity</u> | Part No. | <u>IPC</u> | Fig./Item |
|------------------------|-----------------|----------|------------|-----------|
| Chamber assy, inner | 1 | B507009 | 72-41-01 | |
| Chamber assy, | 1 | B507010 | 72-41-01 | |

72-41-01 Repair No.20 Page 429 Jun 1/88



6. Welding Data

A. Process A.

- (1) Method of Welding:
 Automatic circumferential argon arc butt.
- (2) Machine:
 Analog 300.
- (3) Positioner:
 Aga.
- (4) Torch: Interlas 301 water cooled.
- (5) Electrode:
 0.125 in. (3,175 mm) thoriated tungsten.
- (6) Arc length: 0.040 in. (1,02 mm).
- (7) Weld Speed:7.0 in./min. (177,8 mm/min.).
- (9) Downslope Time:
 10 sec.
- (10) Torch Gas:
 22 cu ft/hr (11 litres/min.) Argon at 15 psi
 (103 kPa).
- (11) Shroud Gas:
 22 cu ft/hr (11 litres/min.) Argon at 15 psi
 (103 kPa).



(12) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(13) Filler Wire:

16 SWG (1,63 mm) MSRR.9500/16.

(14) Direction of weld from outside.

B. Process B.

(1) Method of Welding:
Automatic circumferential argon arc butt.

(2) Machine:
Analog 300.

(3) Positioner:

Aga.

(4) Torch:

(5)

Electrode:

M301.

0.125 in. (3,175 mm) thoriated tungsten.

(6) Arc length:
 0.030 in. (0,76 mm).

(7) Weld Speed: 5.0 in./min. (127,0 mm/min.).

(8) Current:
70 amps.



(9) Torch Gas:

22 cu ft/hr (11 litres/min.) Argon at 15 psi (103 kPa).

(10) Backing Gas:

88 cu ft/hr (44 litres/min.) Argon at 30 psi (206 kPa).

(11) Filler Wire:

16 SWG (1,63 mm) MSRR.9500/16.

(12) Direction of weld from outside.



<u>COMBUSTION CHAMBER (2BR) - REPAIR</u> FITTING OVERSIZE VAPORISER LOCATION PINS

MODIFICATION NO. OL. 8898C

1. Effectivity

| <u> </u> | Fig./Item | <u>Part Number</u> |
|----------|-----------|---|
| 72-41-01 | 2 10 | B512865, B513927, B514702, B514706, B516665, B517450, B516671, B517452, B935462, B935463, B936627, B936862, B936865, B936884, B936938, B938013, B938014, B938015, B938016, B938017, B938020, B938021, B938022, B938173, B938501 |

2. Introduction

A. General.

- (1) This repair describes the procedure for drilling worn vaporiser location pin holes oversize, and fitting oversize headless or stepped pins.
- (2) Dimensions are shown thus; INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-meters) unless otherwise stated.

REPAIR

72-41-01



- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. Instructions

A. Machine.

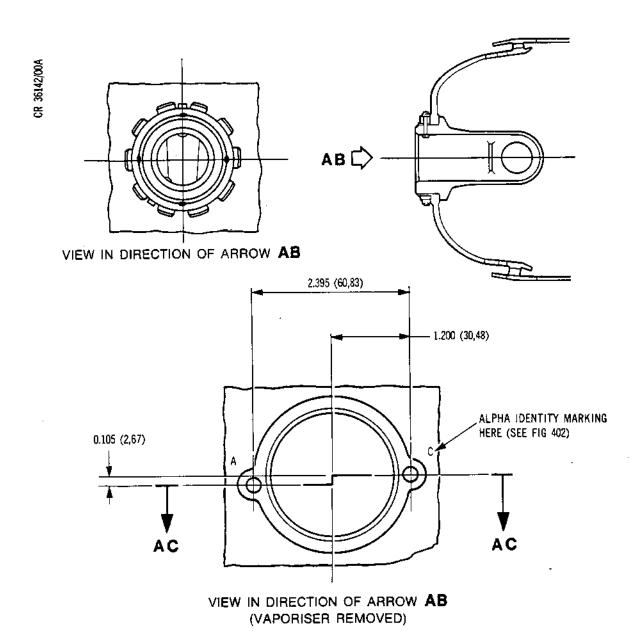
- (1) Locate the combustion chamber on the table of a jig boring machine with the vaporiser locations upwards.
- (2) Bore out the defective hole to the next size (Ref. Figs. 401, 402), to suit a headless or a stepped pin.
- (3) Remove burrs and sharp edges.

B. Inspect.

- (1) Inspect for the satisfactory completion of the machining operation. Check the hole size and position.
- (2) Crack test the combustion chamber using the dye penetrant process specified in Chapter 72-41-01 Inspection/Check or TSD 594 OP 203/213.

C. Assemble Pin.

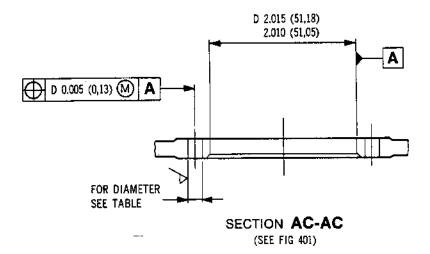
- (1) Select a headless or stepped pin to suit the bore of the machined hole (Ref. Fig. 402).
- (2) Using a suitable freezing agent, shrink the pin and assemble it in the hole, ensuring that the pin is correctly located (Ref.Fig.402).



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

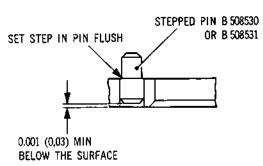
Combustion Chamber Vaporiser Locations Figure 401

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HEADLESS PIN 8 507924 OR B 507925 OR B 507925 0.001 (0,03) TO 0.005 (0,13) BELOW THE SURFACE

ENLARGED PART SECTION AC-AC (SEE FIG 401)



ENLARGED PART SECTION AC-AC (SEE FIG 401)

| HOLE DIA | PIN NUMBER | IDENTITY MARKING SUFFIX | SALVAGE NUMBER |
|----------------------------------|------------|----------------------------|-------------------|
| 0.1992 (5,060) 0.1985 (5,042) | B 507924 | А | В 507923 |
| 0.2012 (5,110) 0.2005 (5,093) | 8 507925 | В | 8 507923 |
| 0.2032 (5,161) 0.2025 (5,144) | B 507926 | С | 8 507923 |
| 0.2112 (5,365) 0.2105 (5,347) | B 508530 | D | B 507929 |
| 0.2172 (5,517) 0.2165 (5,499) | B 508531 | Ē: | B 507929 |

DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Location Pin and Salvage Number Identification Figure 402

REPAIR

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D. Identify.

- (1) Mark the following on the front fairing adjacent to the existing part number, using electro-chemical or vibro-percussion marking as instructed in Chapter 72-09-00 Repair:
 - (a) Salvage number SAL B507923 and/or SAL B507929 as appropriate (Ref. Fig. 402), or R21.
 - (b) Identity marking suffix A, B, C, D or E (Ref. Fig. 402) as appropriate in the position shown in Figure 401.

E. Final Inspection.

(1) Finally inspect the combustion chamber to ensure that the repair has been carried out satisfactorily, and that the chamber is in a serviceable condition.

4. Special Tools, Fixtures and Equipment

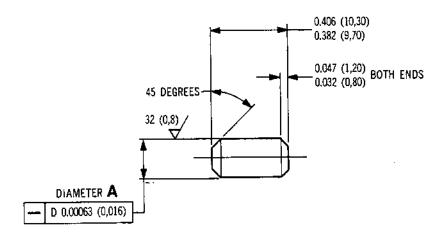
None.

5. Replacement Parts

| <u>Description</u> | <u>Quantity</u> | <u>Part No.</u> | <u>Fig.Ref.</u> |
|--------------------|-----------------|-----------------|-----------------|
| Pin, headless | A/R | B507924 | 403 |
| Pin, headless | A/R | 8507925 | 403 |
| Pin, headless | A/R | B507926 | 403 |
| Pin, stepped | A/R | B508530 | 404 |
| Pin, stepped | A/R | B508531 | 404 |

NOTE: The above parts may be manufactured by the customer.

CR 36144/00A



| PART NUMBER | DIA 🗛 |
|-------------|----------------------------------|
| B 507924 | 0.1998 (5,075) 0.1993 (5,063) |
| B 507925 | 0.2018 (5,126) 0.2013 (5,114) |
| B 507926 | 0.2038 (5,177) 0.2033 (5,164) |

MATERIAL SPEC: BS HR1 OR HR601

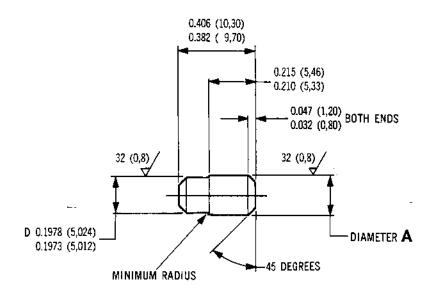
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Headless Pin Dimensions Figure 403

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CR 36145/00A



| PART NUMBER | DIA A |
|-------------|----------------------------------|
| B 508530 | 0.2118 (5,380) 0.2113 (5,368) |
| 8 508531 | 0.2178 (5,532) 0.2173 (5,520) |

MATERIAL SPEC: BS HR1 OR HR601

DIMENSIONS GIVEN ARE SHOWN Thus:- Inches (Millimetres)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Stepped Pin Dimensions Figure 404

72-41-01 Repair No.21 Page 407 Dec 1/88



COMBUSTION CHAMBER (2 BR) - REPAIR REMOVAL OF MINOR CRACKS IN VAPORISERS BY BLENDING

MODIFICATION NO. OL.8921C

Effectivity

<u>IPC</u> <u>Fig./Item</u> <u>Part No.</u> 72-41-01 2 50 8499243

2. Introduction

A. General.

- (1) This repair describes the procedure for removing minor cracks in vaporisers by blending.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.
- B. Repair Limitations.
 - (1) This repair is limited to one blend in any one blend area (Ref. Fig. 401). Blend areas are to be a minimum of 0.600 in. (15,2 mm) apart.



3. Instructions

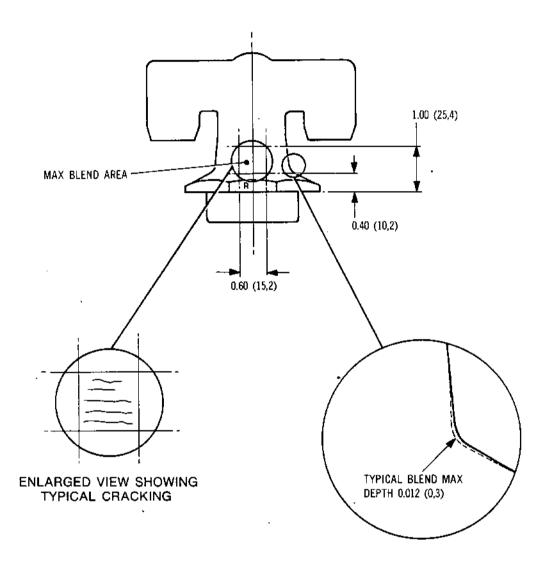
- A. Inspect.
 - (1) Crack test the vaporiser using the F1 dye penetrant process specified in Chapter 72-09-00 Inspection/ Check or TSD 594 OP 213.
- B. Blend Cracks.
 - (1) Blend and polish using conventional hand tools to remove the cracks, to a maximum depth of 0.012 in. (0,30 mm). Blending must be within the repair limitations (Ref. paragraph 2B) and centred on the defect (Ref. Fig.401).
- C. Inspect.
 - (1) Locally etch the blended area using the swab etching method with solution E as detailed in Chapter 72-09-14 Repair, or TSD 594 OP 214.
 - (2) Crack test the vaporiser using the F1 dye penetrant process specified in Chapter 72-09-00 Inspection/Check or TSD 594 OP 213.
- D. Identify.
 - (1) Mark salvage No. B506045 or R22 close to the existing part number using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.
 - (2) Mark the letter R on the hexagon flat nearest to the repaired area using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.
- E. Final Inspection.
 - (1) Finally inspect the vaporiser to ensure that the repair has been carried out satisfactorily, and that the vaporiser is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

Replacement Parts

None.





DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Vaporiser Blending Areas Figure 401

72-41-01 Repair No.22 Page 403 Jun 1/90



CHAMBER, ASSEMBLY COMBUSTION

REPAIR OF CRACKING/BURNING IN THE No.7 INNER COOLING RING AND ADJACENT FORWARD SECTION BY DIRECT/PUDDLE WELDING

REPAIR NO.B514672

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|--------------------|
| 72-41-01 | 2 / 10R | B512865 |
| | 108 | B513927 |
| | 10T | B514702 B514706 |
| | 100 | B516665 B517450 |
| | 10V | B516671 B517452 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 32(0,8) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection
All welds are classified as Group 2.

72-41-01 Repair No. 23

Page 401 Jun 30/00

REPAIR



| 4 - | REPAIR PROCEDURE | SUPPLEMENTARY INFORMATION |
|-----|--------------------------------|---------------------------|
| 1) | Remove the 16 off self-locking | Refer Overhaul Manual |

Degrease component.

Refer TSD 594 OP.101.

 Visually inspect to identify areas of cracking and burning.

shank nuts from the rear flange.

Refer Figs. 401 and 402.

Chapter 72-09-00 Repair.

4) Mask off all areas of thermal barrier coating except areas within 0.500(12,70) of damage location.

Refer TSD 594 0P.704.

5) Abrasive blast to completely remove the existing coatings from damage location.

Refer Overhaul Manual Chapter 72-09-25 Process K using OMat 184.

6) Dress to remove bond coating from damage location.

Use hand tools only.
Grinding is not permitted.

7) Groove out principal cracks for their complete length.

Use hand tools only.
Grinding is not permissible.

8) Inert gas arc weld grooved locations.

Refer TSD 594 OP.409 Use filler wire OMat 3/62.

 Visually inspect external surface to identify area of burning.

10) Dress to remove external area of burning to approximately two thirds parent material thickness.

Use hand tools only. Grinding is not permissible.

11) Restore dressed area by inert gas are puddle welding.

Refer TSD 594 OP.409
Use filler wire OMat 3/62.

NOTE: Apply chromium plated copper chills as close as possible to the area of welding to reduce distortion.

12) On the internal surface, dress the corresponding burned area to approximately two thirds parent material thickness.

Use hand tools only. Grinding is not permissible.

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13) Restore dressed area by inert gas arc puddle welding.

Refer TSD 594 OP.409 Use filler wire OMat 3/62.

NOTE: Apply chromium plated copper chills as close as possible to the area of welding to reduce distortion.

14) Dye penetrant inspect repair area (both sides). Refer Overhaul Manual Chapter 72-41-01 Inspection/Check.

15) Radiographically inspect repair area.

Refer TSD 594 OP.409. Weld classification group 2.

16) Dress excess areas of puddle weld flush to restore profile of both internal and external surfaces. Parent material thickness not to be impaired.

Use hand tools only. Grinding is not permitted. Refer Fig. 401.

- 17) Heat treat at 1150°C ± 10°C in vacuum or inert atmosphere for 15 minutes.
 Rapid inert gas quench.
- 18) Heat treat at 800°C ± 10°C in a vacuum or inert atmosphere for 8 hours.

 Rapid inert gas quench then allow to cool to room temperature.
- 19) Dye penetrant inspect component.

Refer Overhaul Manual Chapter 72-41-01 Inspection/Check.

20) Re-apply thermal barrier coating to repaired area.

Refer Overhaul Manual Chapter 72-41-01 Repair No.14 (Part 2). Do not mark the salvage number for Repair No. 14.

21) Assemble and fit 16 replacement self-locking shank nuts to the rear flange.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Para.8. Replacement Parts, Item 2.

> 72-41-01 Repair No. 23

REPAIR

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22) Mark Repair Instruction Number RI B514672 or R23 on component adjacent to normal 'assembly' no. using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig. 401 for identity marking location.

5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u> <u>RR CODE</u>

CHAMBER, ASSEMBLY, MSRR 7038 QAU

COMBUSTION C263

6. DATA

NONE.

7. <u>TOOLS</u>

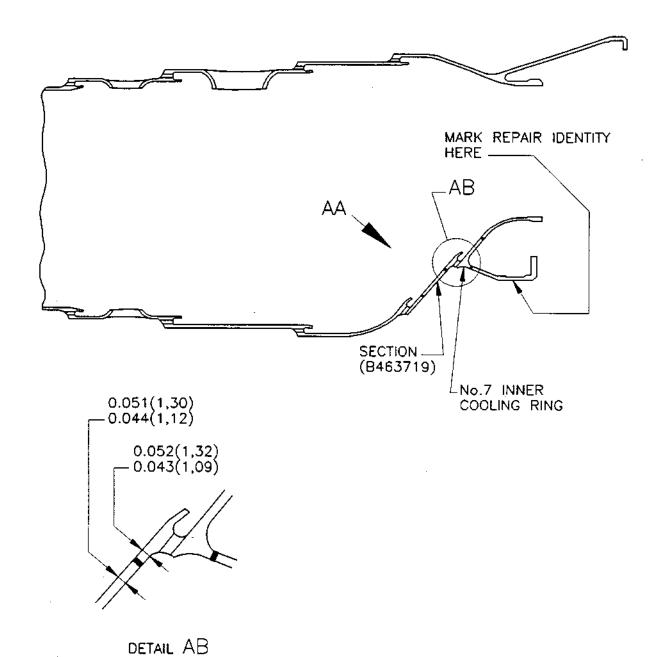
TOOL NUMBER DESCRIPTION ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

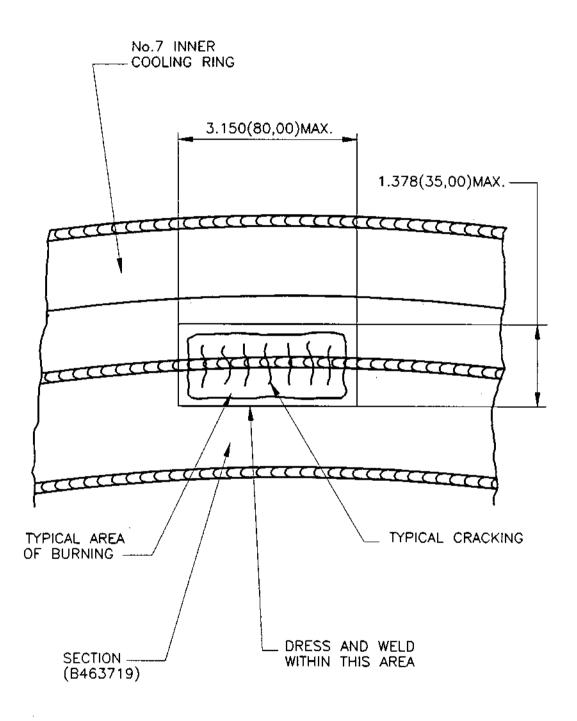
AS27871 SHANK NUT 16 1



TYPICAL SECTION THROUGH CHAMBER FIG.401

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TYPICAL V — AA FIG.402

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CHAMBER ASSEMBLY, COMBUSTION

REPLACEMENT OF HEAD, SUB-ASSY. OF USING ENGINE RUN OR NEW INNER AND/OR OUTER BARRELS (POST MOD.8981).

B516207

1. EFFECTIVITY

IPC Fig./Item Part No.

72-41-01 2 10T B514702

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair Authority for agreement.

After welding, ovality and shrinkage on items indicated Z (refer fig.404) may be up to minus 0.240 (6,10) on diameter.

The igniter hole positions (refer fig.403) may be plus/minus 0.050 (1,27) from the horizontal centre line of the Combustion Chamber after welding.

This Repair may be used in any combination with Repairs in the range B935550-1, B935553-79 and B935582.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection
All welds are classified as Group 2.

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. REMOVE SHANK NUTS AND VAPORISERS.
- Remove the vaporisers as instructed.

Refer to OVERHAUL MANUAL Chapter 72-41-01 Repair No. 8. Do not mark the salvage number for Repair No.8.

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2) Remove the self-locking shanknuts from the rear flange. Refer to fig.401.
Refer to OVERHAUL MANUAL
Chapter 72-09-00 Repair.

3) Visually inspect to ensure satisfactory removal of shank nuts. Refer to fig.401.
Refer to OVERHAUL MANUAL
Chapter 72-09-00 Repair.

B. REMOVE HEAD, SUB-ASSY. OF.

CAUTION: THE No.2 INNER AND OUTER COOLING RINGS ARE THE FIRST COOLING RINGS BEHIND THE FRONT FAIRING.

1) Locate the Chamber Assy. Of, Combustion on the Datum A face on a surface table. Mark two lines on the inner and outer No.2 cooling rings, 0.200 (5,08) from the weld line between the No.2 cooling rings and the adjacent sections 17.800 (452,12) and 17.720 (450,09) respectively from the datum A flange face.

Refer to fig.401. Use OMat 264 or similar.

2) Identify the Barrels, Assy. Of Outer and Inner, as a pair. Use temporary markers or tags.

3) Locate the chamber in holding fixture, using packing to support the inner chamber. Separate the chamber by cutting circumferentially around the two lines marked at para.4.8.1, using a plasma torch and anti-spatter guard.

Refer to para.4. Tools, items 3 and 4. A mechanical cutter may be used as an alternative method if preferred.

- 4) Remove items from fixture.
- 5) Clean up the Barrels, Assy. Of Inner and Outer to remove spatter beads. Ensure no thinning of parent metal occurs.
- 8) Visually inspect to ensure satisfactory removal of Head, Sub-Assy. Of.

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- C. MACHINE BARREL, ASSY. OF, OUTER OR REPLACEMENT BARREL, ASSY. OF OUTER.
- 1) Locate the Barrel, Assy. Of Outer on a surface table on the rear flange, and mark the 20.310 (515,87) dimension.

Refer to fig.402. Refer to para.8. Parts, item 8 if required. Use OMat 264 or similar.

2) Locate the Barrel, Assy. Of Outer to holding fixture and locate fixture assy. To a vertical centre lathe and set true. Refer to para.7. Tools, item 1.

3) Machine the Barrel, Assy. Of Outer to an overall height of 20.310 (515,87). Remove burrs.

Refer to fig.402.

4) Inspect to ensure 20.310 (515,87) dimension has been achieved satisfactorily.

Refer to fig. 402.

5) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.213.

- 6) Where the previous weld joint was plasma-sprayed, or where there is a requirement to remove the whole plasma coating proceed as follows:
 - a) Dry abrasive blast
 - i) Blast using aluminium oxide grit 18/24 mesh to remove the thermal barrier coat for a distance of 0.250 (6,35) minimum from the joint edge.

Refer to OVERHAUL MANUAL Chapter 72-09-24 Repair.

(ii) Blast using aluminium oxide grit 18/24 mesh to remove the thermal barrier coat all over. Refer to OVERHAUL MANUAL Chapter 72-09-24 Repair.

- b) Weld preparation
- i) Prepare the edge for welding using an aluminium oxide scurf mop.

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OVERHAUL

D. MACHINE BARREL, ASSY. OF INNER OR REPLACEMENT BARREL, ASSY. OF INNER.

1) Locate the Barrel, Assy. Of Inner, on a surface table on the rear flange, and mark the 17.600 (447,04) dimension.

Refer to fig.402. Refer to para.8. Parts, item 7 (if required). Use OMat 264 or similar.

2) Locate the Barrel, Assy. Of Inner, to holding fixture and locate fixture to a vertical centre lathe and set true. Refer to para.7. Tools, item 3.

3) Machine the Barrel, Assy. Of Inner. to an overall height of 17.600 (447,04) from the datum A flange face. Remove burrs.

Refer to fig.402.

4) Inspect to ensure 17.600 (447,04) dimension has been achieved satisfactority.

Refer to fig. 402.

5) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.213.

- 6) Where the previous weld joint was plasma-sprayed, or where there is a requirement to remove the whole plasma coating proceed as follows:
 - a) Dry abrasive blast
 - i) Blast using aluminium oxide grit 18/24 mesh to remove the thermal barrier coat for a distance of 0.250 (6,35) minimum from the joint edge.

Refer to OVERHAUL MANUAL Chapter 72-09-24 Repair.

(ii) Blast using aluminium oxide grit 18/24 mesh to remove the thermal barrier coat all over. Refer to OVERHAUL MANUAL Chapter 72-09-24 Repair.

- b) Weld preparation
- i) Prepare the edge for welding using an aluminium oxide scurf mop.

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7) Store the Barrels, Assy. Of Inner and Outer as required.

Previously identified as a pair para.4.B.2); keep them as a matched pair.

- E. APPLY COATINGS.
- Withdraw from stores the Barrel, Assy. Of Inner and Outer stored as a pair at para.4.D.7) and new Head, Sub-Assy. Of.

Refer to para.8. Replacement Parts, items 1, 7 and 8.

Plasma spray the inner and outer No.2 cooling rings of Head, Sub-Assy. Of.

Refer to OVERHAUL MANUAL Chapter 72-41-01, Repair No.14.

3) Apply Sermaloy J to Head, Sub-Assy. Of. Refer to OVERHAUL MANUAL Chapter 72-41-01, Repair No.19.

NOTE: The Sermaloy J coating is to overlap the plasma spray coating by 0.100/0.200 (2,54/5,08).

4) Plasma spray the Barrel, Assy. Of Inner and Barrel, Assy. Of Outer (as required).

Refer to OVERHAUL MANUAL Chapter 72-41-01, Repair No.14.

- F. ATTACH BARREL ASSY. OF INNER AND BARREL ASSY. OF OUTER TO HEAD SUB-ASSY. OF.
- 1) Heat treat Barrels, Assy. Of Inner and Outer to 1150°C ± 10°C for 15 minutes in vacuum or inert atmosphere. Rapid inert gas quench.
- Remove the existing vaporiser seating pads from fixture and store in container. Attach the location and support blocks in adapter set, refer to fixture.

Refer to para.7. Tools, items 6, 7 and 8.

NOTE: When replacing sections of the Chamber, Assy. Of, Combustion, it is usually necessary to expand existing sections to match the replaced part, prior to welding. Expansion is carried out on the particular area, adjacent to that being replaced. This is achieved by using segmented, or split rings of local manufacture (refer to para.7. Tools, items 11 to 15 for outer chamber and refer to para.7. Tools, items 16 to 18 for inner chamber).

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72-41-01 Repair No. 25 Page 405 3) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use OMat 583. Refer to TSD 594 OP.101.

Assemble the Barrel, Assy. Of Inner to the Head, Assy Of using welding fixture. Ensure the longitudinal welds are in the correct position. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown.

Refer to fig's 403 to 405. Refer to para.7. Tools, items 6 to 8.

NOTE: The Barrel, Assy. Of Inner, must be located in the fixture using the four dowel holes on rear face (refer to fig.403). It may be necessary to shim under the vaporiser location positions to remove any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 (0,76) at any one position.

5) Manually tackweld diametrically opposite, the Barrel, Assy. Of Inner and the Head, Assy. Of using argon backing stand and argon backing head.

Refer to fig.404.
Refer to para.7. Tools, items 6 and 7.
Refer to TSD 594 OP.409 using filler rods to OMat 3/62.

- 6) Visually inspect to ensure no excessive mismatch exists. If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the Head, Assy. Of from the Barrel Assy. Of Inner, and after dressing and cleaning, the tackwelding procedure repeated.
- 7) Remove the Head/Barrel Assy. Of, from the fixture and clamp to a welding table. Using argon backing stand and argon backing head, automatically weld the Head, Sub-Assy. Of to the Barrel, Assy of Inner.

Refer to fig.404.
Refer to para.7. Tools, items 8 and 9.
Refer to para.6. Data process A and TSD 594 OP.409.

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8) Visually inspect to ensure that the weld protrusion is complete and does not exceed the permissible amount shown. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the Barrel, Assy. Of Inner must be removed from the Head, Sub-Assy. Of, by plasma cutting and machining, as detailed previously, and the whole procedure repeated.

Refer to fig.405.

NOTE: Any unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burn or an aluminium oxide scurf mop.

9) Inspect to ensure the repair limit 20.545/20.645 (521,84/524,38) dimension has been achieved and that the welding has been carried out satisfactorily.

Refer to fig. 404.

10) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.213.

11) Assemble the Barrel, Assy. Of, Outer to the Head/Barrel, Sub-Assy. Of, Inner using welding fixture with adaptor set fitted. Ensure the longitudinal welds are in the correct position as shown. Form the mating ends to ensure correct alignment using conventional hand tools. Mismatch must not exceed the limits shown.

Refer to fig's 404 and 405. Refer to para.7. Tools, items 6 to 8.

K.610-14-28 snecm OVERHAUL

NOTE: The Head Sub-Assy. Of/Barrel Assy. Of Inner, is located in the fixture using the dowels and shimming as previously detailed at para.4.E.4). Barrel Assy. Of Outer is located using the fixture locating pin (reference 'View AD' fig.405), engaged in the 0.900 (22,86) diameter hole (reference 'View AD' fig.405). It may be necessary to wedge up the outer head assembly slightly to overcome any slight swash present and achieve a good mating fit at the joint surfaces. Care must be taken not to damage the Head, Assy. Of Outer skin.

12) Manually tackweld diametrically opposite, the Head/Barrel, Assy. of to the Barrel Assy. Of, Outer, using argon backing stand and argon backing head.

Refer to figs.403 and 484. Refer to para.7. Tools, items 6 to 8. Refer to TSD 594. OP.409 using filler rods to OMat 3/62.

13) Visually inspect to ensure no excessive mismatch exists. If excessive mismatch does exist, then mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible, then the tackwelds must be broken to remove the Head/Barrel, Assy. Of Inner from the Barrel, Assy. Of Outer and after dressing and cleaning, the tackwelding procedure repeated.

Refer to fig.405.

14) Remove the Combustion Assy. Of, Chamber from the fixture and clamp to welding table. Using argon backing stand automatically weld the Head/Barrel, Sub-Assy. Of to Barrel, Assy. Of Outer.

Refer to fig.404.
Refer to para.7. Tools, items 6 to 8.
Refer to para.6. Data, process B and TSD594 OP.409 for welding.

15) Visually inspect that the weld protrusion is complete and does not exceed the permissible amount shown. If excessive, dress using a cutter or aluminium oxide scurf mop. Grinding must not be used, and no thinning of parent metal is permissible. If not complete, rectify with a weld re-run. If still unsatisfactory, the Head/ Barrel, Assy. Of Inner, must be removed from the Barrel, Assy. Of Outer by plasma cutting and machining as detailed previously, and the whole procedure repeated.

Refer to fig.405.

NOTE: Any unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burr or an aluminium oxide scurf mop.

16) Inspect to ensure the repair limit 2.650/2.710 (67,31/68,83) dimension shown has been achieved and that the welding has been carried out satisfactorily.

Refer to fig. 404.

17) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.213.

- TRUE UP CHAMBER. G.
- Generally true up the Chamber 1) Assy. Of, Combustion using standard shop tools to achieve the tolerances shown.

Refer to fig. 404. Refer to para.2. REPAIR LIMITATIONS.

- HEAT TREAT. н.
- 1) Locate Chamber Assy. Of, Combustion to heat treatment support ring and place component/fixture assy. in vacuum/argon furnace.

Refer to para.7. Tools, item 9.

> REPAIR 72-41-Repair No. 25



- 2) Heat treat Chamber, Assy. Of, Combustion to 800°C ± 5°C for 8 hours. Rapid inert gas quench.
- 3) Dye penetrant inspect component. Refer TSD 594 OP.213.
- J. FINAL TRUE UP OF CHAMBER.
- Finally true up the Chamber, Assy. Of, Combustion using standard shop tools to achieve the tolerances shown.

Refer to fig.404.
Refer to para.2. REPAIR
LIMITATIONS.

Dye penetrant inspect component.

Refer TSD 594 OP.213

- K. ASSEMBLE VAPORISERS.
- Withdraw from stores Pins, serviceable vaporisers and retaining nuts previously removed and rivets.

Refer to para.8. Parts, items 2 to 5.

 Assemble the 16 vaporisers nuts and rivets.

Refer to OVERHAUL MANUAL Chapter 72-41-D1, Repair No.8. Do not mark the Salvage number for Repair No.8.

- L. INSTALL THE SHANK NUTS.
- Withdraw new shank nuts from stores.

Refer to para.8. Parts, item 6.

2) Locate the shank nuts progressively to rear flange, and swage over into the countersunk holes. Refer to OVERHAUL MANUAL Chapter 72-09-00 Repair.

M. IDENTIFY.

Allocate and mark the replacement Head, Assy. Of Serial Number to Head and new Barrel Assy. Of Inner and/or Outer. Mark Repair instruction number RI B516207 or R25 adjacent to normal 'assy of' number using the vibro-percussion engraving technique.

Refer OVERHAUL MANUAL Chapter 72-09-00 Repair.



5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u>

RR CODE

CHAMBER, COMBUSTION,

ASSY. OF.

C263 MSRR 7038 MSRR 7036

Q A U Q A R

6. WELDING DATA

NOTE: Weld data is given for guidance only; optimum settings should be determined by experiment using suitable test pieces. For further information refer to TSD 594 OP.409.

- A. Process A.
 - 1) Method of Welding:

Automatic circumferential argon arc butt.

2) Machine:

Analog 300.

3) Positioner:

Aga.

4) Torch:

Interlas model 301, Water cooled.

5) Electrode:

0.125 (3,18) thoriated tungsten.

6) Arc Length:

0.040 (1,02).

7) Weld Speed:

7.000 in./min. (177,80 mm/min.).

8) Current:

70-74 amps.

9) Downslop Time:

10 sec.

REPAIR

72-41-01 Repair No. 25 Page 411 Sep 30/94 10) Torch Gas:

22 cu ft/hr (11 Litres/min.) Argon at 15 psi (103 kPa).

11) Shroud Gas:

22 cu ft/hr (11 Litres/min.) Argon at 15 psi (103 kPa).

12) Backing Gas:

88 cu ft/hr (44 Litres/min.) Argon at 30 psi (206 kPa).

13) Filler wire:

16 s.w.g. OMat 3/62.

14) Direction of weld is from the outside.

B. Process B.

Method of Welding:
 Automatic circumferential argon arc butt.

2) Machine:

Analog 300.

3) Positioner:

Aga.

4) Torch:

M 301.

5) Electrode:

0.125 (3,18) thoriated tungsten.

6) Arc Length:

0.030(0.76).

7) Weld Speed:

5.000 in./min. (127,80 mm/min.).

8) Current:

70 amps.

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9) Torch Gas:

22 cu ft/hr (11 Litres/min.) Argon at 15 psi (103 kPa).

10) Backing Gas:

88 cu ft/hr (44 Litres/min.) Argon at 30 psi (206 kPa).

13) Filler wire:

16 s.w.g. OMat 3/62.

14) Direction of weld is from the outside.

7. <u>TOOLS</u>

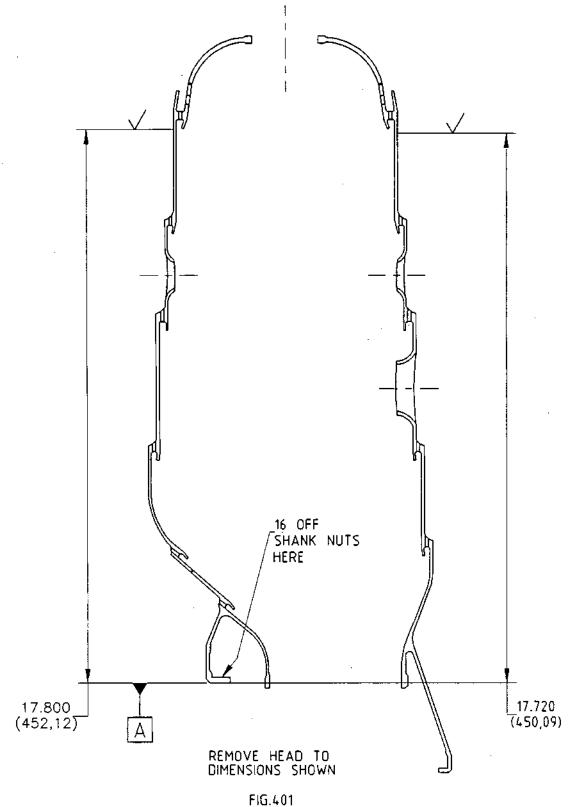
| TOOL NUMBER | DESCRIPTION | QUANTITY | <u>ITEM</u> |
|---------------|--------------------|----------|-------------|
| \$3\$15231000 | Holding Fixture | 1 | 1 |
| S3S15919000 | Anti-spatter guard | 1 | 2 |
| S3S12437000 | Holding Fixture | 1 | 3 |
| S3S12445000 | Argon Backing Stan | d 1 | . 4 |
| \$3\$12446000 | Argon Backing Head | 1 | 5 |
| S3S12431000 | Welding Fixture | 1 | 6 |
| S3S15910000 | Adaptor Set | 1 | 7 |
| S3S15936000 | Container | 1 | 8 |
| S3S12439000 | Support Ring | 1 | 9 |
| S3S11698000 | Container | 1 | 10 |
| S3S14014000 | Expanding Shoe | 1 | 11 |
| \$3\$12769000 | Tapered Plug | 1 | 12 |
| \$3\$12770000 | Wedge Segment | 12 | 13 |
| S3S12771000 | Restraining Ring | 1 | 14 |
| \$3\$12772000 | Expanding Former | 16 | 15 |
| \$3\$12777001 | Wedge Former | 12 | 16 |
| S3S12777002 | Wedge Former | 12 | 17 |
| S3S12800000 | Restraining Ring | 1 | 18 |
| | | | |

8. REPLACEMENT PARTS

| PART NUMBER | DESCRIPTION | QUANTITY | <u>ITEM</u> |
|-------------|-----------------------|----------|-------------|
| B516206 | Head Sub-Assy. Of | 1 | 1 |
| AS20669 | Pin | 3.2 | 2 |
| B499243 | Vaporiser | A/R | 3 |
| B495785 | Retaining Nut | A/R | 4 |
| AS16258 | Rivet | 16 | 5 |
| AS27871 | Shank Nut | 16 | 6 |
| B507009 | Barrel, Assy. Of, Inn | er A/R | 7 |
| B507010 | Barrel, Assy. Of, Out | | 8 |

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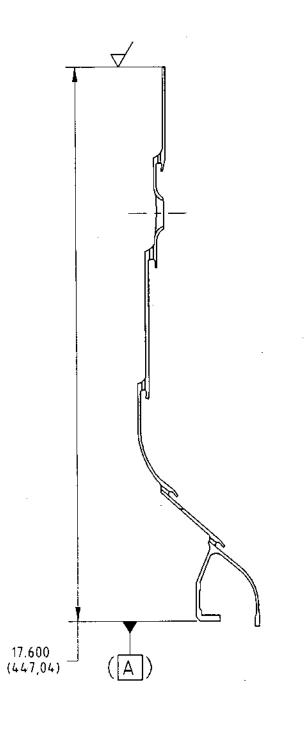


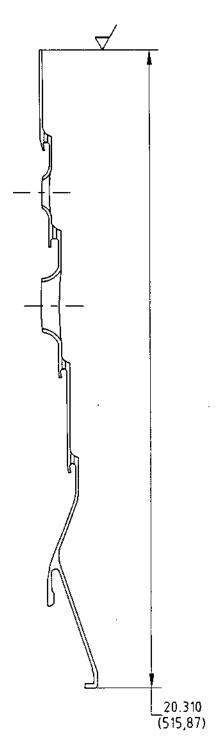


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MK.610-14-28 snecma OVERHAUL





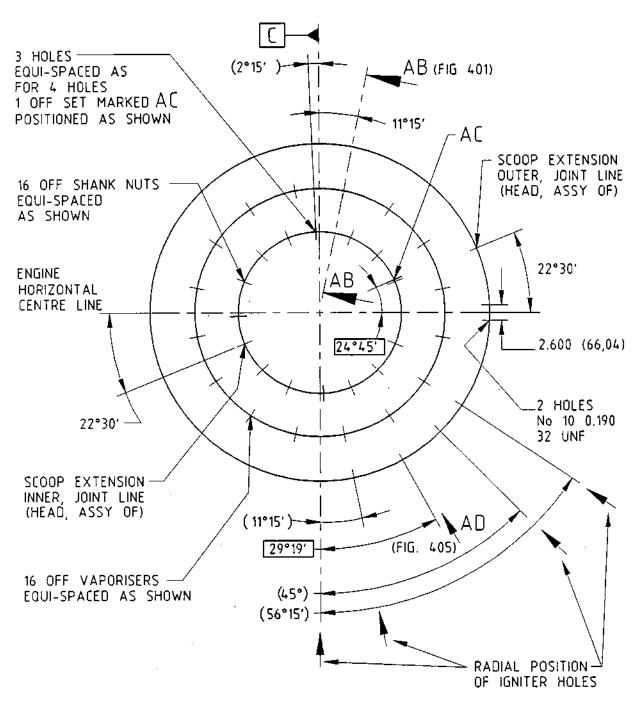
MACHINE BARRELS TO DIMENSIONS SHOWN

FIG.402

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DIAGRAMMATIC VIEW LOOKING FORWARD SHOWING ALIGNMENT OF EXISTING HOLES RELATIVE TO HEAD, ASSY OF

FIG.403

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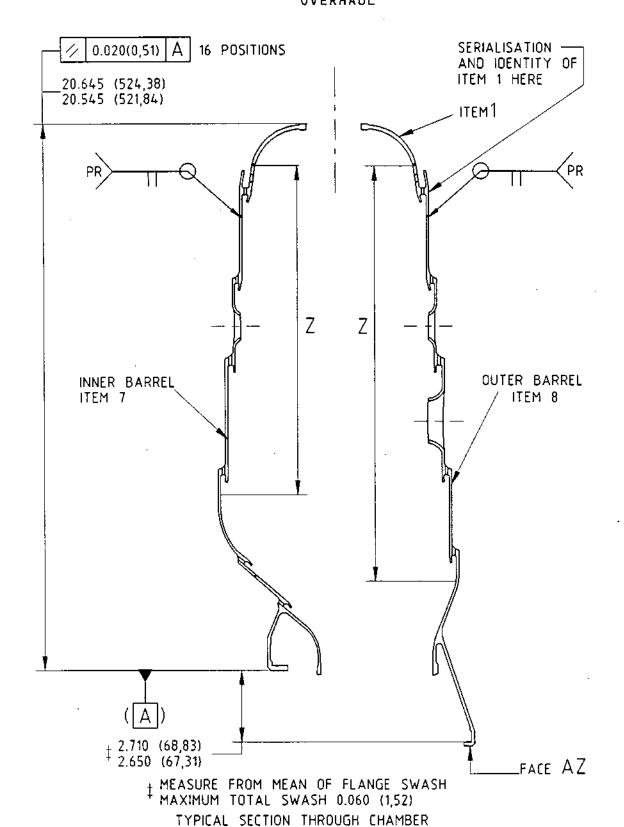
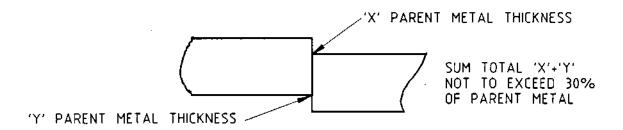


FIG. 404.

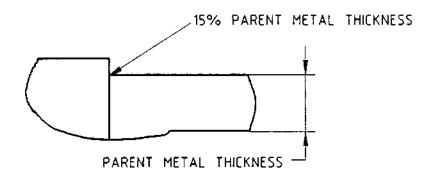
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DOUBLE STEP MANUAL AND MECHANISED WELD JOINTS



STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

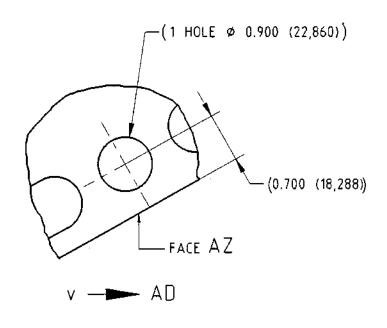


FIG.405

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CHAMBER, ASSEMBLY, COMBUSTION

REPLACEMENT OF HEAD SUB-ASSY. OF USING ENGINE RUN OR NEW INNER AND/OR OUTER BARRELS (POST MOD.9008).

B517529-30

1. EFFECTIVITY

| <u>IPC</u> | Fiq./Item | Part No. |
|------------|-----------|--------------------|
| 72-41-01 | 2 10N | B938173 |
| | 10R | B512865 |
| | 10s | B513927 |
| | 10T | B514702 B514706 |
| | 100 | B516665 B517450 |
| | 10V | B516671 B517452 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair Authority for agreement.

After welding, ovality and shrinkage of Outer and Inner Barrels, over area AC, may be as much as minus 0.240(6,10) on diameter (refer Fig.404).

The igniter hole positions (refer fig.407) on re-used Outer Barrels may be plus/minus 0.050(1,27) from the horizontal centre line of the Combustion Chamber after welding.

After repair there may exist in a re-used Outer Barrel two additional (and redundant) igniter ports, these are acceptable in the rework condition.

New or re-used Inner and Outer Barrels may be welded to either type of Head sub-assy and part numbered accordingly (refer to Table A).

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GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection
All welds are classified as Group 2.

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. Remove Shank Nuts and Vaporisers.
- 1) Remove the 16 off Vaporisers as instructed.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the salvage number for Repair No.8.

- 2) Remove the 32 off Vaporiser locating pins, taking care not to damage the holes.
- 3) Remove the self-locking Shank-Nuts from the rear flange. Care must be taken not to damage the flange.

Refer Fig.411. Refer Overhaul Manual Chapter 72-09-00 Repair.

3) Visually inspect rear flange to ensure satisfactory removal of Shank Nuts.

Refer to Overhaul Manual Chapter 72-09-00 Repair.

B. Remove Head, Sub-Assy. Of.

NOTE: The No.2 Inner and Outer cooling rings are the first cooling rings behind the Front Fairing.

1) Locate the Datum A face of the Combustion Chamber on to a surface table. Mark two lines on the inner and outer No.2 cooling rings, 0.200(5,08) from the weld line between the No.2 cooling rings and the adjacent sections 17.800(452,12) and 17.720(450,09) respectively from the datum A flange face.

Refer Fig. 402. Use OMat 264 or similar.

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- 2) Identify the Inner and Outer Barrels as a pair.
- 3) Locate the Combustion Chamber in holding fixture, and use packing to support the Inner Chamber. Separate the chamber by cutting circumferentially around the two lines marked at para.4.B.1, using a plasma torch and anti-spatter guard.

Use temporary markers or tags.

Refer fig. 402.
Refer to para.7. Tools,
items 1 and 2. A mechanical
cutter may be used as an
alternative method if
preferred.

- 4) Remove items from fixture.
- 5) Clean up the Inner and Outer Barrels to remove spatter beads. Ensure no thinning of parent metal occurs.
- 6) Visually inspect to ensure satisfactory removal of Head sub-assy.
- C. Machine Outer Barrel.

NOTE: This procedure is only applicable if Outer Barrel is to be re-used.

1) Heat treat the Outer Barrel to 1150°C ± 10°C in a vacuum for 15 to 30 minutes.
Cool by rapid gas quench.

Suitable fixtures or restraint is required to maintain feature control.

2) Dimensionally inspect Outer Barrel for excessive distortion and if necessary true-up using conventional hand tools. Refer figs 408 and 409.

3) Locate the Outer Barrel on a surface table on the rear flange, and mark the 20.310 (515,87) dimension.

Refer to fig.403. Use OMat 264 or similar.

4) Locate the Outer Barrel to holding fixture and locate fixture assy to a vertical centre lathe and set true.

Refer to para.7. Tools, item 1.

5) Machine the Outer Barrel to an overall height of 20.310 (515,87). Remove burrs.

Refer to fig. 403.

REPAIR

72-41-01 Repair No. 26 Page 403 Dec 1/96 5) Inspect to ensure 20.310 (515,87) dimension has been achieved satisfactorily.

Refer to fig. 403.

7) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

- 8) Visually inspect existing plasma sprayed thermal barrier coating for condition.
- 9) If required, locally or completely remove damaged thermal barrier coating.

Refer to Overhaul Manual Chapter 72-09-24 Repair for removal method.

D. <u>Machine Inner Barrel.</u>

NOTE: This procedure is only applicable if Inner Barrel is to be re-used.

1) Heat treat the Inner Barrel to $1150^{\circ}\text{C} \pm 10^{\circ}\text{C}$ in a vacuum for 15 to 30 minutes. Cool by rapid gas quench.

Suitable fixtures or restraint is required to maintain feature control.

2) Dimensionally inspect Inner Barrel for excessive distortion and if necessary true-up using conventional hand tools.

Refer figs 408 and 410.

3) Locate the Inner Barrel on a surface table on the rear flange, and mark the 17.600 (447,04) dimension.

Refer to fig.403. Use OMat 264 or similar.

4) Locate the Inner Barrel to holding fixture and locate fixture assy to a vertical centre lathe and set true. Refer to para.7. Tools, item 3.

5) Machine the Inner Barrel to an overall height of 17.600 (447,04). Remove burrs.

Refer to fig.403.

6) Inspect to ensure 17.600 (447,04) dimension has been achieved satisfactorily. Refer to fig.403.

7) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

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- 8) Visually inspect existing plasma sprayed thermal barrier coating for condition.
- If required, locally or completely remove damaged thermal barrier coating.

Refer to Overhaul Manual Chapter 72-09-24 Repair for removal method.

10) Store the Inner and Outer Barrels as required.

Previously identified as a pair para.4.B.2, keep them as a matched pair.

- E. Apply Coatings.
- 1) Withdraw from stores a new Head Sub-Assy and new/or re-used Inner and Outer Barrels.

Refer to para.8 Replacement Parts items 1 to 6.

NOTE: The following heat treatment is only applicable to new Inner or Outer Barrels B507009 and B507010.

2) Heat treat at 1150° C \pm 10° C in a vacuum for 15 to 30 minutes. Cool by rapid gas quench.

Suitable fixtures or restraint is required to maintain feature control.

3) Plasma spray the inner and outer No.2 cooling rings of Head Sub-Assy. Refer to Overhaul Manual Chapter 72-41-01, Repair No.14 (part 2). Do not mark the salvage number for Repair No.14.

4) Apply Sermaloy J to Head sub-Assy. Refer to Overhaul Manual Chapter 72-41-01, Repair No.19. Do not mark the salvage number for Repair No.19.

NOTE: The Sermaloy J coating is to overlap the plasma spray coating by 0.100/0.200 (2,54/5,08).

5) Diffusion heat treat the Head sub-assy. Heat treat for 2 hours at 800°C ± 5°C in constant Argon flow.

6) Plasma spray the Inner and Outer Barrels (as required). Ensure weld joint area remains free of coating. Refer to Overhaul Manual Chapter 72-41-01, Repair No.14 (part 2). Do not mark the salvage number for Repair No.14.

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- F. Attach Inner and Outer Barrels to Head Sub-Assy.
- Manipulate/expand Inner and Outer Barrels so as to achieve dimensional requirements.

Refer Figs. 408 to 410.

2) Dye penetrant inspect Inner and Outer Barrels. Refer TSD 594 0P.213

3) Remove the existing vaporiser seating pads from fixture and store in container. Attach the location and support blocks in adapter set to fixture. Refer to para.7. Tools, items 6, 7 and 8.

4) If necessary expand and/or manipulate the Inner and Outer Barrels to ensure that the respective diameters match those of the No.2 inner and outer cooling rings of Head sub-assy.

Refer to para.7. Tools, items 11 to 14 for Outer Barrel and items 11 and 15 to 17 for Inner Barrel.

5) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease. Use OMat 583. Refer to TSD 594 OP.101.

6) Assemble the Inner Barrel to the Head sub-assy using the welding fixture with adapter set fitted. Ensure longitudinal welds are in the correct position. Refer figs 404, 405, 408 and 411. Refer para.7. Tools, items 6 to 8.

- NOTE: The Inner Barrel must be located in the fixture using the four dowel holes on rear face (refer to figs.408, 411 and 412). It may be necessary to shim under the vaporiser location positions to remove any slight swash present and achieve a good mating fit at the joint faces. Shimming is permitted up to a maximum of 0.030 (0,76) at any one position.
- 7) Tackweld, diametrically opposite, the Inner Barrel to the Head sub-assy using argon backing stand and head.

Refer to fig.404.
Refer to para.7. Tools, items 4 and 5.
Refer to TSD 594 OP.409 using filler rods to OMat 3/62.

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- 8) Remove from fixture and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- Locate and clamp the Head/Barrel sub-assy to a welding table.
- 1D) Automatically weld the Head/ Barrel sub-assy with a fully penetrating single-sided weld using argon backing stand and head.

Refer to fig.404.
Refer to para.7. Tools, items 4 and 5.
Refer to TSD 594 OP.409 using filler rods to OMat 3/62.

11) Visually inspect weld protrusion. Weld protrusion to be 0.010(2,54) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer TSD 594 0P.409.

NOTE: Any unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burn or an aluminium oxide scurf mop.

12) Dimensionally inspect to ensure repair limit (Dimn.AE) has been achieved and that the welding has been carried out satisfactorily.

Refer fig.404. Refer TSD 594 OP.409.

13) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

14) Assemble the Outer Barrel to the Head/Inner Barrel sub-assy using the welding fixture with adapter set fitted. Ensure the longitudinal welds are in the correct position.

Refer figs.404, 405, 406, 408, 409 and 413. Refer para.7. Tools, items 6 to 8.

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NOTE: The Head/Inner Barrel sub-assy is located in the fixture using the dowels and shimming as previously detailed at para.4.F.7. The Outer Barrel is located using the fixture locating pin engaged in the 0.900(22,86) diameter hole (reference 'View AU' figs.407 and 414). It may be necessary to wedge up the Outer Head assembly slightly to overcome any slight swash present and achieve a good mating fit at the joint surfaces. Care must be taken not to damage the outer skin of the Head sub-assy.

15) Tackweld, diametrically opposite, the Outer Barrel to the Head/Inner Barrel sub-assy using argon backing stand and head.

Refer to fig.404.
Refer to para.7. Tools, items 4 and 5.
Refer to TSD 594 OP.409 using filler rods to OMat 3/62.

- 16) Remove from fixture and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 17) Locate and clamp the Combustion Chamber assy to a welding table.
- 18) Automatically weld the Outer Barrel to the Head/Inner subassy with a fully penetrating single-sided weld using argon backing stand and head.

Refer to fig.404.
Refer to para.7. Tools, items 4 and 5.
Refer to TSD 594 OP.409 using filler rods to OMat 3/62.

19) Visually inspect weld protrusion. Weld protrusion to be 0.010(2,54) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

NOTE: Any unremoved bond coat of the plasma spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burr or an aluminium oxide scurf mop.

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20) Dimensionally inspect to ensure repair limits have been achieved and that the welding has been carried out satisfactorily.

Refer to figs.404 and 408. Refer to TSD 594 OP.409.

21) Locally dye penetrant inspect weld location.

Refer to TSD 594 OP.213.

- G. <u>True up Flanges.</u>
- Generally true up Combustion Chamber Assy using standard shop tools to achieve the required Feature Controls.

Refer to figs.408 to 410. Refer to para.2. Repair Limitations.

- H. <u>Heat Treat.</u>
- Locate Combustion Chamber Assy to heat treatment support ring and place component/fixture assy in vacuum furnace.

Refer to para.7. Tools, item 9.

2) Heat treat Combustion Chamber Assy to 800°C ± 5°C for 8 hours. Cool by rapid gas quench.

NOTE: If preferred the post Sermaloy 'J' diffusion heat treatment may be included into the final age heat treatment providing total time at 800°C equals 8 hours.

- 3) Dye penetrant inspect component. Refer TSD 594 OP.213.
- J. Final True up of Chamber.
- 1) Finally true up the Combustion Chamber Assy using standard shop tools to achieve the required Feature Controls.

Refer figs.408 to 410. Refer to para.2. Repair Limitations.

- Dye penetrant inspect component. Refer TSD 594 OP.213
- K. Machine Igniter Ports.

NOTE: This procedure is only for Combustion Chamber Assembly where a new Outer Barrel (B516667) has been fitted.

 Locate Combustion Chamber to fixture. Refer to para.7. Tools, item 1.

REPAIR

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- 2) Locate component/fixture assy to jig boring machine.
- Produce two off igniter holes to the dimensions shown.

Refer to fig.407.

4) Remove component from fixture, deburr and radius edge of each igniter hole. Refer to fig. 407.

5) Dimensionally inspect machined locations.

Refer to fig.407.

6) Remove Plasma Spray from around inner surface of machined locations to the required dimensions.

Refer to fig.407.
Refer Overhaul Manual
Chapter 72-41-01, Repair
No.14 for removal method.

7) Locally dye penetrant inspect machined locations.

Refer to TSD 594 OP.213.

- L. Assemble Vaporisers.
- Withdraw from stores 32 off pins.

Refer to para.8. Replacement Parts, item 7.

2) Shrink fit the 32 pins in position at the 16 vaporiser locations to the dimensions shown. Refer fig. 415.

3) Assemble the 16 vaporisers as instructed.

Refer to Overhaul Manual Chapter 72-41-01, Repair No.8. Do not mark the Salvage number for Repair No.8. Refer to para.8. Replacement Parts, items 8 to 10.

- M. Install the Shank nuts.
- Withdraw new shank nuts from stores.

Refer to para.8. Replacement Parts, item 11.

2) Locate the shank nuts progressively to rear flange, and swage over into the countersunk holes. Refer to Overhaul Manual Chapter 72-09-00 Repair. Refer fig.412.

3) Inspect to ensure satisfactory installation of shank nuts.

Refer to Overhaul Manual Chapter 72-09-00 Repair. REPAIR

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N. Identify.

For pre-mod 9008 part numbers line through existing assembly number and mark on new assembly number relevant to which head assy of has been fitted (refer to Table A) using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer fig.401.

For all part numbers mark Repair Instruction number RI B517529 or R26A or RI B517530 or R26B relevant to which head assy of. has been fitted (refer to Table A) adjacent to normal assembly number using the vibro-percussion engraving technique.

| Existing Assembly Number | Replacement Head Sub Assy Of. | New Assembly Number | Repair Instruction Number |
|---|-------------------------------------|---------------------------|---------------------------------|
| B938173 B512865 B513927 B514702 B514706 | B516669 | B517450 | B517529 (R26A) |
| B516665 B517450 | B516669 | . N/A | B517529 (R26A) |
| B938173 B512865 B513927 B514702 B514706 | в516673 | B517452 | B517530 (R26B) |
| B516671 B517452 | B516673 | N/A | B517530 (R26B) |

TABLE A

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5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u> <u>RR CODE</u>

CHAMBER, ASSEMBLY, MSRR 7038 COMBUSTION. MSRR 7036

MSRR 7038(C263) QAU MSRR 7036(C263) QAR

6. WELDING DATA

NONE.

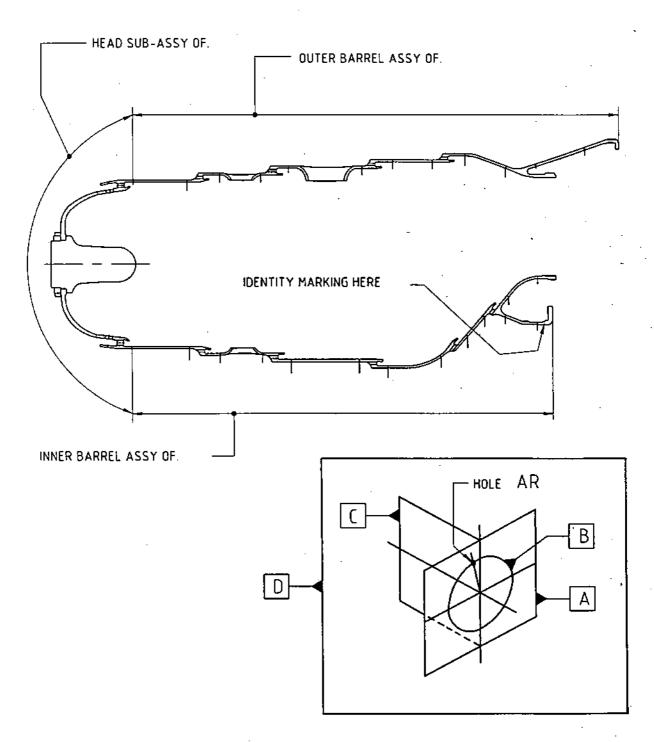
7. <u>TOOLS</u>

| TOOL NUMBER | DESCRIPTION | QUANTITY | <u>item</u> |
|----------------------------|-------------------|----------|-------------|
| s3s15231000 | Holding Fixture | 1 . | 1 |
| S3S15919000 | Anti-spatter guar | ·d 1 | 2 |
| S3S12437000 | Holding Fixture | 1 | . 3 |
| \$3\$12445000 | Argon Backing Sta | and 1 | 4 |
| S3S12446000 | Argon Backing Hea | | 5 |
| S3S12431000 | Welding Fixture | 1 | 6 |
| S3S15910000 | Adaptor Set | 1 | 7 |
| s3s15936000 | Container | 1 | 8 |
| S3S12439000 | Support Ring | 1 | 9 |
| S3S12437000 S3S11698000 | Container | i | 10 |
| S3S12769D00 | Tapered Plug | i | 11 |
| - | Wedge Segment | 12 | 12 |
| S3S12770000 | • | · - | 13 |
| s3\$12771000 | Restraining Ring | | _ |
| S3S12772000 | Expanding Former | | 14 |
| S3S12777001 | .Wedge Former | 12 | 15 |
| S3S12777002 | Wedge Former | 12 | 16 |
| \$3\$12800000 | Restraining Ring | 1 | 17 |

8. REPLACEMENT PARTS

| PART NUMBER | DESCRIPTION | QUANTITY | <u>ITE</u> M |
|---|---|--|--------------------------------------|
| B516673 B516669 B516668 B516667 B507009 B507010 AS20669 B499243 B495785 | Head Sub-Assy. Of Head Sub-Assy. Of Barrel, Assy. Of, Barrel, Assy. Of, Barrel, Assy. Of, Barrel, Assy. Of, Pin Vaporiser Retaining Nut | A/R A/R Inner A/R Outer A/R Inner A/R Outer A/R 32 A/R A/R | 1 2 3 4 5 6 7 8 |
| AS16258 AS27871 | Rivet Shank Nut | 16 16 | 10 11 |

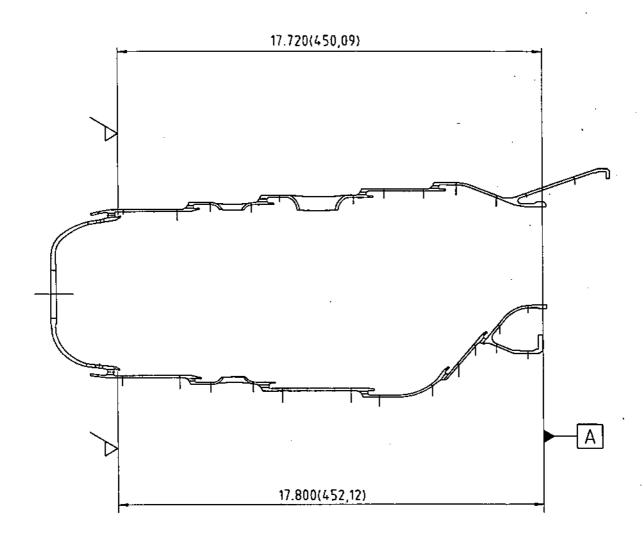
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TYPICAL SECTION THROUGH COMBUSTION CHAMBER ASSY. FIG. 401.

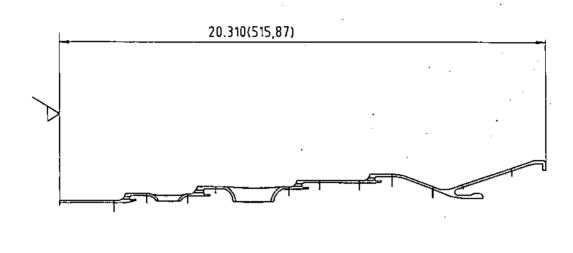
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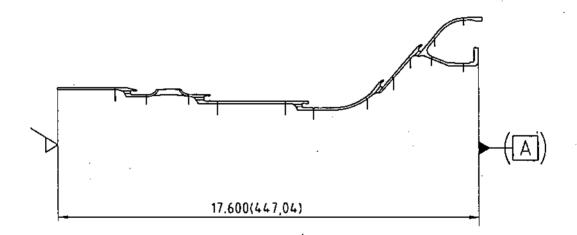




VIEW SHOWING CUT-OFF DIMENSIONS. FIG.402.

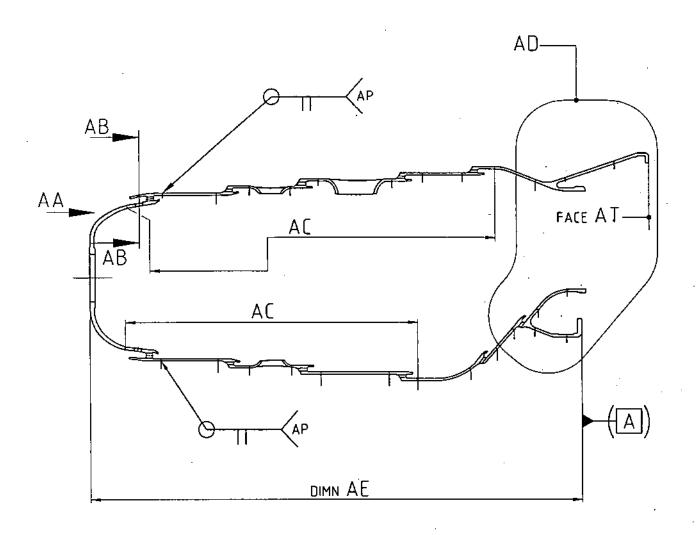
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VIEW SHOWING MACHINING OF RE-USED BARRELS FIG.403.

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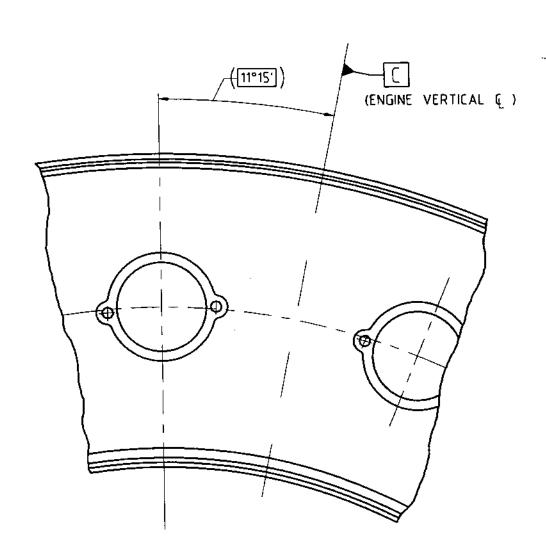


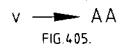
| REPLACEMENT HEAD SUB-ASSY OF. | ріми. АЕ. | |
|----------------------------------|----------------------------------|--|
| B516669 | 20.620(523,75) 20.520(521,21) | |
| B516673 | 20.645(524,38) 20.545(521,84) | |

TABLE B.

VIEW SHOWING WELDING DETAILS. FIG.404

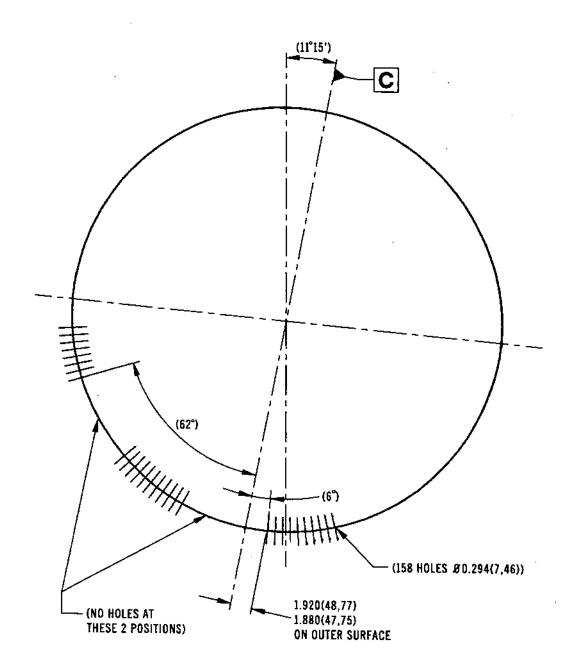
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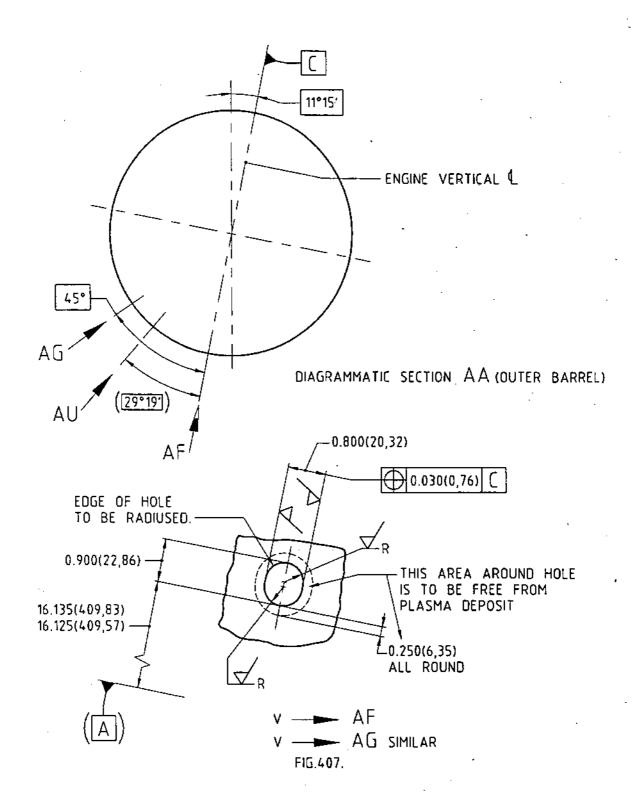
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BS00028129/1



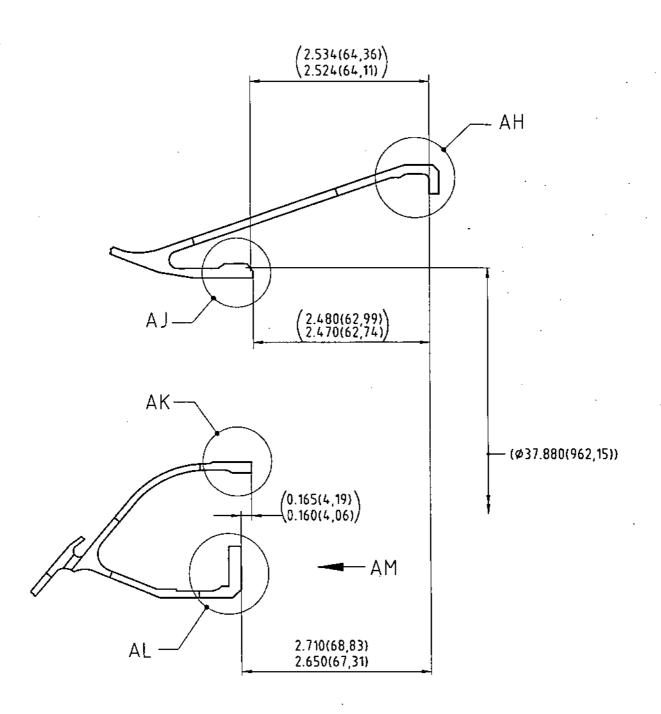
SECTION AB FIG.406.

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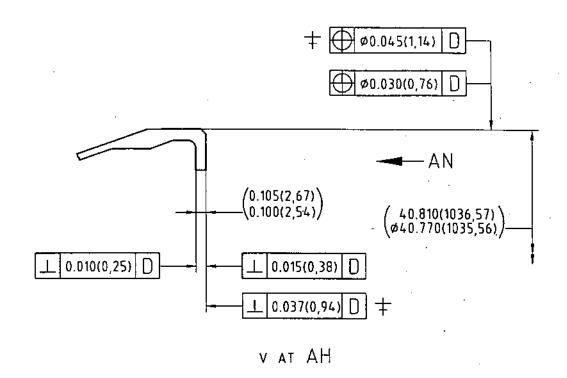


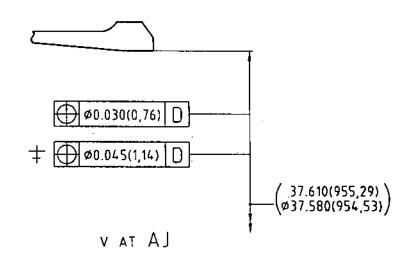


VIEW AT AD FIG.408.

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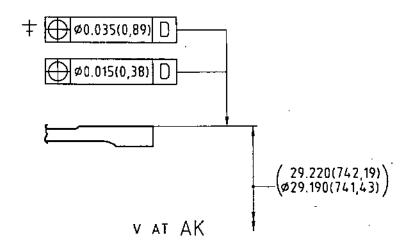


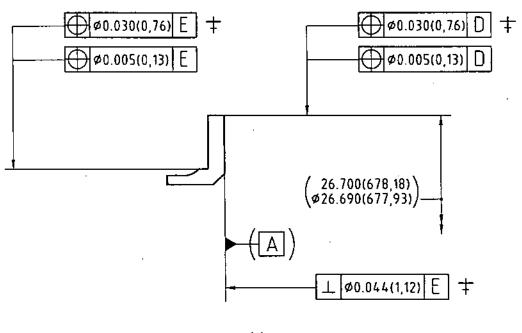




+ ONLY APPLICABLE IF OUTER BARREL HAS BEEN RE-USED.

FIG.409.



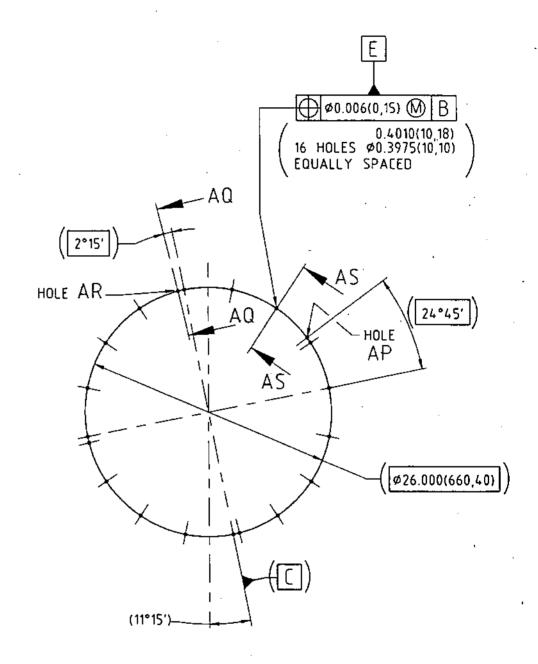


V AT AL

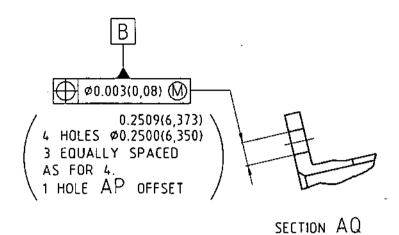
TONLY APPLICABLE IF INNER BARREL HAS BEEN RE-USED.

FIG.410.

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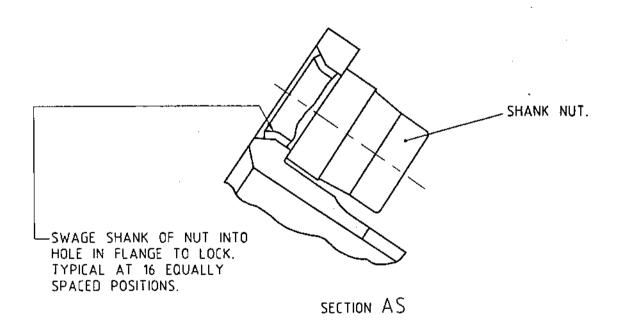
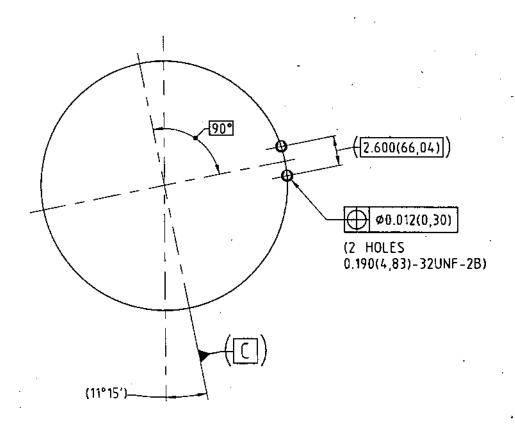


FIG.412.

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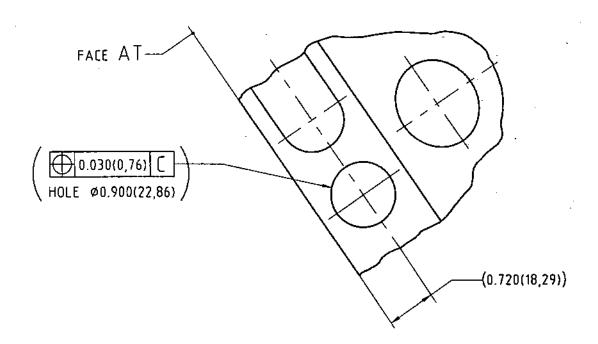


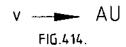


DIAGRAMMATIC VIEW — AN

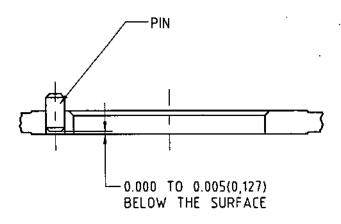
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SECTION THROUGH VAPORISER PIN LOCATION

FIG.415.



CHAMBER, ASSEMBLY, COMBUSTION

REPLACEMENT OF DAMAGED SECTIONS

B517456-93

1. EFFECTIVITY

| IPC | Fig_/Item | <u>Part No.</u> |
|----------|-----------|--------------------|
| 72-41-01 | 2 100 | B516665 B517450 |
| | 1 O V | B516671 B517452 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

After welding, ovality and shrinkage of Inner and Outer barrels, over length BR, may be as much as minus 0.240(6,10) on diameter. (Refer Fig.407).

The igniter hole positions (refer Fig. 423) on outer barrels may be plus/minus 0.050(1,27) from the horizontal centre line of the Combustion Chamber after welding.

For replacement of Head Sub-assy of, refer to Repair No.26.

Repairs may be used singly, or in any suitable combination. (Refer Figs 401 to 404).

Damaged items -4 and -5 or -28 and -29 may not be replaced individually.

Cut-off dimensions and minimum drop dimensions are shown on Figs.409 and 410. The drop dimension is the important factor in all cases and must override the reference cut-off dimensions.

GENERAL

In order to simplify Repair, the Combustion Chamber is sub-divided into identifiable parts. (Refer to Figs 401 and 402).

To simplify selection of Repair, the procedure is divided into sections as specified below:

4A. REMOVE VAPORISERS, LOCATING PINS AND SHANK NUTS.

NOTE: This procedure to be applied prior to the commencement of any of the following repairs.

- 4B. REPLACING INNER BARREL ASSEMBLY.
- 4C. REPLACING OUTER BARREL ASSEMBLY.
- 4D. REPLACEMENT OF INNER/OUTER SCOOP(S).
- 4E. REPLACEMENT OF NO.3 INNER COOLING RING AND ADJACENT INNER FRONT CHAMBER SECTION.
- 4F. REPLACEMENT OF NO.3 OUTER COOLING RING AND ADJACENT OUTER FRONT CHAMBER SECTION.
- 4G. REPLACING THE REAR OUTER FLANGE.
- 4H. REPLACING THE REAR INNER FLANGE.
- 4J. REPLACEMENT OF DAMAGED SECTIONS/RINGS GENERAL.
- 4K. ASSEMBLE VAPORISERS.
- 4L. INSTALL THE SHANK NUTS.
- 4M. IDENTIFY.

In order to provide access and maintain axial dimensions it may be necessary to remove and subsequently replace sections other than those found to be damaged. Serviceable items may be re-used.

It is permissible to replace a number of sections/rings by either single stage build-up onto the base unit or to assemble a number of sections/rings and then fit to base unit.

It is not necessary to cut through the rearward adjacent section when replacing a ring. If replacing ring only, cut through the ring 0.200(5,08) from weld line in all cases.

REPAIR

72-41-01 Repair No. 27 Page 402 Dec 31/99 Rather than individually heat treat replacement Cooling Rings and Chamber Sections, it is permissible to heat treat them as a batch along with Inner/Outer Barrel assemblies.

After repair there may exist in the Outer Barrel, two additional (and redundant) igniter ports. These are acceptable.

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES16D)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection
All welds are classified as Group 2.

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

A. REMOVE VAPORISERS, LOCATING PINS AND SHANK NUTS.

NOTE: The following procedure to be applied prior to the commencement of any repairs.

 Remove the 16 off Vaporisers as instructed. Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the Salvage number for Repair No.8.

- 2) Remove the 32 off Vaporiser Locating Pins, taking care not to damage holes.
- 3) Remove the Self-locking Shank Nuts from the Rear Flange. Care must be taken not to damage the flange.

Refer Fig. 426. Refer to Overhaul Manual Chapter 72-09-00 Repair.

4) Visually inspect to ensure satisfactory removal of Shank Nuts.

Refer Fig.426. Refer to Overhaul Manual Chapter 72-09-00 Repair.

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B. REPLACING INNER BARREL ASSEMBLY

1) Locate Chamber on its flanged end on a surface table. Mark a line circumferentially around the Inner Barrel section (ref. item -29) 0.200(5,08) below the weld line with No.2 Cooling Ring.

Refer Fig.402. Use Omat 264 or similar.

2) Locate the Chamber in holding fixture using packing to support the Inner Barrel. Separate the Chamber by cutting circumferentially around the line marked at para.4.B.1. using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

- 3) Remove items from fixture.
- 4) Clean to remove spatter bead from Outer Barrel/Head assy. Ensure no thinning of parent metal occurs.

Heat treat Outer Barrel/Head assy.

- 5) Clean to remove any traces of marking medium.
- 6) Heat treat at 1150°C ± 10°C in a vacuum for 30 minutes. Cool by rapid gas quench.

Use suitable fixtures or restraint to maintain feature controls.

7) Inspect Outer Barrel/Head assy for excessive distortion and if necessary, true-up using conventional hand tools.

Machine Outer Barrel/Head assy

8) Locate the Outer Barrel/Head assy to index fixture and locate fixture assy on a vertical centre lathe and set true. Refer to para.7.Tools, item 3.

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9) Machine the Outer Barrel/Head assy to produce the 20.371 (517,42) dimension. Remove burrs.

Refer Fig. 411.

10) Inspect to ensure dimension has been satisfactorily achieved. Refer Fig. 411.

11) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Inspect Sermaloy J coating.

- 12) Visually inspect the Sermaloy J coating on the front fairing for condition.
- 13) If necessary, repair damage using procedure specified.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.19. Do not mark the salvage number for Repair No.19.

Inspect Thermal Barrier coating.

- 14) Visually inspect the Thermal Barrier coating on the Outer Barrel for condition.
- 15) If required, locally or completely remove coating.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14 for removal method.

Plasma spray.

16) Withdraw from stores a new Inner Barrel.

Refer to Fig. 403 item 2.

NOTE: The following heat treatment is only applicable if Inner Barrel B507009 is used.

17) Heat treat at 1150°C ± 10°C in a vacuum for 15 to 30 minutes.

Cool by rapid gas quench.

Use suitable fixtures or restraint to maintain feature controls.

72-41-01 Repair No. 27 Page 405 Jun 1/97 18) Plasma spray the Inner Barrel (and Outer Barrel if required) as instructed. Ensure weld joint area remains free of coating. Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14.(Part 2). Do not mark the salvage number for Repair No.14

Attach Inner Barrel to Outer Barrel/Head assy.

19) If necessary, expand the Inner Barrel to obtain the correct match with Head assy. Refer to para.7.Tools, items 4 to 7.

20) Remove the existing vaporiser seating pads from fixture and store in container. Attach the items in adapter set to fixture. Refer to para.7.Tools, items 8, 9 and 10.

21) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease. Use Omat 583. Refer to TSD 594 OP.101.

22) Assemble the Inner Barrel to the Outer Barrel/Head assy using the welding fixture. Ensure the longitudinal welds are in the correct position.

Refer to Fig. 408.
Refer to para. 7. Tools, items 8 and 9.

NOTE: The Inner Barrel must be located in the fixture using the four dowel holes on rear face. (Refer to Fig. 426). It may be necessary to shim under the vaporiser location positions to remove any slight swash present and achieve a good mating fit at joint faces. Shimming is permitted up to a maximum of 0.030 (0,76) at any one position.

23) Tackweld, diametrically opposite, the Inner Barrel to the Outer Barrel/Head assy using argon backing stand and head.

Refer to Fig. 407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP. 409
using filler rods to Omat
3/62.

- 24) Remove from fixture and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 25) Locate and clamp the Chamber assy to a welding table.

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26) Automatically weld the Inner Barrel to the Outer Barrel/ Head assy with a fully penetrating single-sided weld using argon backing stand and head. Refer to Fig. 407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP. 409
using filler rods to Omat
3/62.

27) Visually inspect weld protrusion. Weld protrusion to be 0.010(0,25) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

NOTE: Any unremoved bond coat of the Plasma Spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burn or an aluminium oxide scurf mop.

28) Dimensionally inspect to ensure repair limit has been achieved and that welding has been carried out satisfactorily.

Refer to Figs.405, 406 and 417. Refer to TSD 594 OP.409.

29) Locally dye penetrant inspect weld location.

Refer TSD 594 0P.213.

Post Weld Heat Treatment.

- 30) Clean the Chamber to remove any traces of marking medium.
- 31) Position Chamber in a vacuum furnace. Heat treat at 800°C ± 5°C. Soak at this temperature for 8 hours.
 Cool by rapid gas quench.

Refer to para.7.Tools, item 16.

True-up Chamber.

32) True-up Chamber completely using standard shop tools to achieve the feature controls.

Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

33) Check that the Chamber has been trued-up satisfactorily.

Refer to Figs.417 to 420.

34) Dye penetrant inspect Chamber.

Refer to TSD 594 OP.213.
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34) Dye penetrant inspect Chamber.

Refer to TSD 594 OP.213.

- C. REPLACING OUTER BARREL ASSEMBLY.
- 1) Locate Chamber on its flanged end on a surface table. Mark a line circumferentially around the Outer Barrel section (ref. item -4) 0.200(5,08) below the weld line with No.2 Cooling Ring.

Refer Fig. 402. Use Omat 264 or similar.

2) Locate the Chamber in holding fixture using packing to support the Inner Barrel. Separate the Chamber by cutting circumferentially around the line marked at para.4.C.1. using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

- 3) Remove items from fixture.
- 4) Clean to remove spatter bead from Inner Barrel/Head assy. Ensure no thinning of parent metal occurs.

Heat treat Inner Barrel/Head assy.

- 5) Clean to remove any traces of marking medium.
- 6) Heat treat at 1150°C ± 10°C in a vacuum for 30 minutes. Cool by rapid gas quench.

Use suitable fixtures or restraint to maintain feature controls.

7) Inspect Inner Barrel/Head assy for excessive distortion and if necessary, true-up using conventional hand tools.

Machine Inner Barrel/Head Assembly.

8) Locate the Inner Barrel/Head assy to index fixture and locate fixture assy on a vertical centre lathe and set true. Refer to para.7.Tools, item 3.

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72-41-01 Repair No. 27 Page 408 9) Machine the Inner Barrel/Head assy to produce the 17.510 (444,75) dimension.
Remove burrs.

Refer Fig. 412.

10) Inspect to ensure dimension has been satisfactorily achieved. Refer Fig. 412.

11) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

12) Inspect Sermaloy J coating.

Refer to para.4.B.op's 12 and 13.

Inspect Thermal Barrier coating.

- 13) Visually inspect the Thermal Barrier coating on the Inner Barrel for condition.
- 14) If required, locally or completely remove coating.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14 for removal method.

Plasma spray.

15) Withdraw from stores a new Outer Barrel. Refer to Fig. 403 item 1.

NOTE: The following heat treatment is only applicable if Outer Barrel B507010 is used.

16) Heat treat at 1150°C ± 10°C in a vacuum for 15 to 30 minutes.
Cool by rapid gas quench.

Use suitable fixtures or restraint to maintain feature controls.

17) Plasma spray the Outer Barrel (and Inner Barrel if required) as instructed. Ensure weld joint area remains free of coating.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14.(Part 2). Do not mark the salvage number for Repair No.14

Attach Outer Barrel to Inner Barrel/Head assy.

18) If necessary, expand the Outer Barrel to obtain the correct match with Head assy. Refer to para.7.Tools, items 4, 13, 14, and 15.

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19) Remove the existing vaporiser seating pads from fixture and store in container. Attach the items in adapter set to fixture. Refer to para.7.Tools, items 8, 9 and 10.

20) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease. Use Omat 583. Refer to TSD 594 OP.101.

21) Assemble the Outer Barrel to the Inner Barrel/Head assy using the welding fixture. Ensure the longitudinal welds are in the correct position.

Refer to Fig. 408. Refer to para.7.Tools, items 8 and 9.

NOTE: The Inner Barrel must be located in the fixture using the four dowel holes on rear face. (Refer to Fig.426). It may be necessary to shim under the vaporiser location positions to remove any slight swash present and achieve a good mating fit at joint faces. Shimming is permitted up to a maximum of 0.030 (0,76) at any one position.

22) Tackweld, diametrically opposite, the Outer Barrel to the Inner Barrel/Head assy using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

- 23) Remove from fixture and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 24) Locate and clamp the Chamber assy to a welding table.
- 25) Automatically weld the Outer Barrel to the Inner Barrel/ Head assy with a fully penetrating single-sided weld using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

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26) Visually inspect weld protrusion. Weld protrusion to be 0.010(0,25) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

NOTE: Any unremoved bond coat of the Plasma Spray may appear as an oxide layer on the surface of the underbead after re-welding. If necessary for inspection purposes, this oxide layer may be removed with a rotary burr or an aluminium oxide scurf mop.

27) Dimensionally inspect to ensure repair limit has been achieved and that welding has been carried out satisfactorily.

Refer to Figs.405, 406 and 417. Refer to TSD 594 OP.409.

28) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Post Weld Heat Treatment.

29) Clean the Chamber to remove any traces of marking medium.

30) Position Chamber in a vacuum furnace.

Heat treat at 800°C ± 5°C.

Soak at this temperature for 8 hours.

Cool by rapid gas quench.

Refer to para.7.Tools, item 16.

True-up Chamber.

31) True-up Chamber completely using standard shop tools to achieve the required feature controls.

Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

32) Check that the Chamber has been trued-up satisfactorily.

Refer to Figs.417 to 420.

33) Bye penetrant inspect Chamber.

Refer to TSD 594 OP.213.

34) Machine igniter ports.

Refer para.4.F.ops 48 to 52.

NOTE: Operation 34 is only applicable if Outer Barrel B516667 has been fitted.

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34) Machine igniter ports.

Refer para.4.F.ops 48 to 52.

NOTE: Operation 34 is only applicable if Outer Barrel B516667 has been fitted.

D. REPLACEMENT OF INNER/OUTER SCOOP(S).

 Locate the Chamber in holding fixture using packing to support the Inner Barrel.

Refer to para.7.Tools, item 1.

- Locate fixture assy on a vertical centre lathe and set true.
- 3) Turn to remove existing Scoop(s) Refer to Figs.427 and 428. (ref.items -31 and -32). Remove burrs.
- 4) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Weld replacement Inner/Outer Scoop to Chamber.

5) Withdraw from stores replacement Scoop(s). Refer to Fig. 404 items 29 and 30.

6) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease. Use Omat 583. Refer to TSD 594 OP.101.

7) Establish the vertical centre line of the Head assy (datum C). Assemble the Scoop to the corresponding Cooling Ring, ensuring the longitudinal weld joint line is positioned correctly in relation to datum C, and the gap between the Scoop and the Cooling Ring is maintained. Form the mating ends to ensure correct alignment using conventional tools.

Refer to Figs 402, 408, 424.

8) Tackweld the Scoop to the Cooling Ring. Position the first tack close to the Scoop longitudinal weld joint line and progressively tack all round. Cut off overlapping material at longitudinal weld joint to form butt. (0.020 (0,50) max gap). Position final tack at the intersection of the longitudinal and circumferential weld joints.

NOTE: Ensure sufficient argon backing is present when tacking.

Refer to Fig.407.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

9) Dress weld tacks to finally remove any mismatch and to flatten the tacks. Use conventional hand tools. Ensure throat gap between Cooling Ring and Scoop is maintained. Refer to Fig. 424.

10) Locate Chamber on its flanged end on a welding table and automatically weld the Scoop to Cooling Ring with a fully penetrating single-sided weld using argon backing stand and head.

NOTE: Ensure sufficient argon backing is present when welding.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

11) Remove Chamber from table.
Tack and hand weld longitudinal joint of Scoop with a fully penetrating single-sided weld using suitable argon backing.
NOTE: Ensure sufficient argon backing is present when welding.

Refer to TSD 594 OP.409 using filler rods to Omat 3/62.

12) Visually inspect weld protrusion. Weld protrusion to be 0.010(0,25) max. Weld may be dressed if necessary using a cutter. Thinning of parent metal or grinding is not permitted.

Refer to TSD 594 OP.409.

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13) Visually inspect to ensure welding has been carried out satisfactorily and throat gap between Cooling Ring and Scoop has been maintained. Refer to Fig. 424.

14) Press and true-up Scoop if necessary using conventional hand tools.

15) Locally dye penetrant inspect weld locations.

Refer TSD 594 OP.213.

16) Locally radiological inspect weld locations.

Refer TSD 594 OP.221.

Post Weld Heat Treatment.

17) Locate Chamber to heat treatment support ring and place Chamber/fixture assy in a vacuum furnace.

Refer to para.7.Tools, item 16.

18) Heat treat at 800°C ± 5°C.
Soak at this temperature for 8 hours.
Cool by rapid gas quench.

True-up Chamber.

19) True-up Chamber completely using standard shop tools to achieve the required feature controls. Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

20) Check that the Chamber has been trued-up satisfactorily. Refer to Figs. 417 to 420.

21) Dye penetrant inspect Chamber.

Refer to TSD 594 OP.213.

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- E. <u>REPLACEMENT OF NO.3 INNER COOLING RING AND ADJACENT INNER</u> FRONT CHAMBER SECTION.
- Locate the Chamber on its flanged end on a surface table and mark three lines as follows.

Refer to Fig.402 Use Omat 264 or similar.

- (a) Circumferentially around the No.3 Inner Cooling Ring (refitem -28) 0.200(5,08) above the weld line between the No.3 Inner Cooling Ring and its lower adjacent section (refitem -27).
- (b) Circumferentially around the Inner Front Chamber Section (ref.item -29) 0.200(5,08) below the weld line between the Inner Front Chamber Section and the No.2 Inner Cooling Ring.
- (c) Circumferentially around the Inner Front Chamber Section (ref.item -29) running through the centreline of the plunged holes.
- 2) Identify the Inner and Outer Barrels as a pair before cutting.
- 3) Locate the Chamber in holding fixture using packing to support the Inner Barrel. Separate the Chamber by cutting circumferentially around the line marked at para.4.E.1.(c) using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

- 4) Remove items from fixture.
- 5) Relocate Outer Barrel/Head assy in fixture and cut back to line marked at para.4.E.1.(b) using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

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Page 415 Dec 31/99 6) Locate Inner Barrel in fixture and cut back to line marked at para.4.E.1.(a) using a plasma torch and spatter guard. Refer to para.7. Tools, items 2 and 17. A mechanical cutter may be used as an alternative method if preferred.

7) Clean to remove spatter bead from Outer Barrel/Head assy and Inner Barrel. Ensure no thinning of parent metal occurs.

Heat treat Outer Barrel/Head assy and Inner Barrel.

- Clean to remove any traces of marking medium.
- 9) Heat treat at 1150°C ± 10°C in a vacuum for 30 minutes. Cool by rapid gas quench. NOTE: Inner Barrel heat treat may be reduced to 15 minutes.

Use suitable fixtures or restraint to maintain feature controls.

10) Inspect Inner Barrel and Outer Barrel/Head assy for excessive distortion and if necessary true-up using conventional hand tools.

Refer to Figs. 417 to 420.

11) Machine Outer Barrel/Head assy.

Refer para.4.B.op's 8 to 11.

Machine Inner Barrel.

12) Locate the Inner Barrel on a surface table on the datum A flange. Mark a line 13.880 (352,55) from datum A circumferentially around barrel.

Refer to Fig.429. Use Omat 264 or similar.

13) Locate Inner Barrel to holding fixture and locate fixture assy on a vertical centre lathe and set true. Refer to para.7.Tools, item 17.

14) Machine Inner Barrel to 13.880 (352,55) dimension marked at para 4.E.13. Remove burrs.

Refer to Fig. 429.

15) Inspect to ensure dimension has been satisfactorily achieved.

Refer to Fig. 429.

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72-41-01 Repair No. 27 Page 416 Jun 1/97 16) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

17) Inspect Sermaloy J coating.

Refer para.4.B.op's 12 and 13.

Inspect Thermal Barrier coating.

- 18) Visually inspect the Thermal Barrier coating on the Outer Barrel/Head assy and Inner Barrel for condition.
- 19) If required, locally or completely remove coating. Ensure coating is removed for a distance of 0.250(6,35) from the weld joint.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14 for removal method.

Produce No.3 Inner Cooling Ring/Inner Front Chamber Section Assy

20) Withdraw from stores replacement No.3 Inner Cooling Ring and Inner Front Chamber Section

Refer to Fig. 404 items -28 and -29.

21) Heat treat at 1150°C ± 10°C in a vacuum for 15 to 30 minutes.

Cool by rapid gas quench.

Refer to General Information.

- 22) Inspect components for excessive distortion and if necessary true-up using conventional hand tools.
- 23) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use Omat 583. Refer to TSD 594 OP.101.

24) Assemble the replacement Inner Front Chamber Section (ref.item -29) to the replacement No.3 Inner Cooling Ring (ref.item -28) using retaining strap. The edge closest to the plunged holes is the abutment face for the No.3 Inner Cooling Ring. Form the mating ends to ensure correct alignment using conventional tools.

Refer to Fig.402 Refer to para.7.Tools, item 18.

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25) Tackweld, diametrically opposite the Inner Front Chamber Section to the No.3 Inner Cooling Ring using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

- 26) Remove retaining strap and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 27) Automatically weld the Inner Front Chamber Section/No.3 Inner Cooling Ring assy with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

28) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

29) Visually inspect to ensure welding has been carried out satisfactorily. Refer to TSD 594 OP.409.

30) Locally dye penetrant inspect weld location.

Refer to TSD 594 OP.213.

Produce Effusion Holes

31) Lightly mark ('pip') the surface of the Inner Front Chamber Section, indicating the position of the 35 outstanding effusion holes at 32 plunged hole positions using a standard B.S. Number 1 centre drill and drill jigs. The jigs are used separately but in conjunction with each other as templates. Ensure correct alignment of drill jigs before 'pipping'.

Refer to Fig. 414. Refer to para.7. Tools, items 19 and 20.

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- 32) Remove drill jigs from Inner Front Chamber Section.
- 33) Drill 32 groups of 35 outstanding effusion holes. Ensure all holes are drilled normal to Chamber Section surface.

Refer to Fig. 414.

- 34) Remove any burrs from the effusion holes using an abrasive cutter.
- 35) Inspect to ensure the correct number of holes have been produced satisfactorily.

Refer to Fig. 414.

36) Dye penetrant inspect the Inner Front Chamber Section/ No.3 Inner Cooling Ring assy. Refer to TSD 594 OP.213.

Weld Inner Front Chamber/No.3 Inner Cooling Ring Assy to Inner Barrel.

37) If necessary expand and/or manipulate the mating parts to ensure correct match of respective diameters. Refer to para.7.Tools, items 4 to 7.

38) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease. Use Omat 583. Refer to TSD 594 OP.101.

39) Assemble the Inner Front Chamber Section/No.3 Inner Cooling Ring Assy to the Inner Barrel using retaining strap. Ensure the longitudinal welds are in the correct angular position.

Refer to Fig.408. Refer to para.7.Tools, item 18.

40) Tackweld, diametrically opposite, the Inner Front Chamber Section/No.3 Inner Cooling Ring Assy to the Inner Barrel using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
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- 41) Remove retaining strap and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 42) Automatically weld the Inner Front Chamber Section/No.3 Inner Cooling Ring Assy/Inner Barrel with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

43) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

44) Visually inspect to ensure welding has been carried out satisfactorily.

Refer TSD 594 OP.409.

45) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Machine Inner Barrel.

46) Locate Inner Barrel to holding fixture and locate fixture assy on a vertical centre lathe and set true. Refer to para.7.Tools, item 17.

47) Machine Inner Barrel to 17.600 (447,04) dimension from datum A flange face. Remove burrs.

Refer to Fig. 411.

48) Inspect to ensure dimension has been satisfactorily achieved.

Refer to Fig. 411.

49) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

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Plasma spray Inner Barrel.

| 50) | Plasma spray the No.3 Inner |
|-----|---------------------------------|
| | Cooling Ring (ref.item -28), |
| ı | adjacent Chamber Section |
| | (ref.item -29) and any areas |
| | where coating has been removed. |
| | Ensure weld joint area |
| | remains free of coating. |

Refer to Fig. 402.
Refer to Overhaul Manual
Chapter 72-41-01 Repair
using Repair No.14.(Part 2).
Do not mark the salvage
number for Repair No.14.

51) Attach Inner Barrel to Outer Barrel/Head Assy. Refer para.4.B.op's 19 to 29.

Post Weld Heat Treatment.

- 52) Clean the Chamber to remove any traces of marking medium.
- 53) Position Chamber in a vacuum furnace.

 Heat treat at 800°C ± 5°C.

 Soak at this temperature for 8 hours.

 Cool by rapid gas quench.

Refer to para.7.Tools, item 16.

True-up Chamber.

54) True-up Chamber completely using standard shop tools to achieve the required feature controls.

Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

55) Check that the Chamber has been trued-up satisfactorily.

Refer to Figs. 417 to 420.

56) Dye penetrant inspect Chamber.

Refer to TSD 594 OP.213.

- F. REPLACEMENT OF NO.3 QUTER COOLING RING AND ADJACENT OUTER FRONT CHAMBER SECTION.
- Locate the Chamber on its flanged end on a surface table and mark three lines as follows.

Refer to Fig.402. Use Omat 264 or similar.

- (a) Circumferentially around the No.3 Outer Cooling Ring (ref. item -5) 0.200(5,08) above the weld line between the No.3 Outer Cooling Ring and its lower adjacent section (ref. item -6).
- (b) Circumferentially around the Outer Front Chamber Section (ref.item -4) 0.200(5,08) below the weld line between the Outer Front Chamber Section and the No.2 Outer Cooling Ring.
- (c) Circumferentially around the Outer Front Chamber Section (ref.item -4) running through the centreline of the plunged holes.
- 2) Identify the Inner and Outer Barrels as a pair before cutting.
- 3) Locate the Chamber in holding fixture using packing to support the Inner Barrel. Separate the Chamber by cutting circumferentially around the line marked at para.4.F.1.(c) using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

- 4) Remove items from fixture.
- 5) Locate Inner Barrel/Head assy in holding fixture and cut back to line marked at para.4.F.1.(b) using a plasma torch and spatter guard.

Refer to para.7. Tools, items 17 and 2. A mechanical cutter may be used as an alternative method if preferred.

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6) Locate Outer Barrel in holding fixture and cut back to line marked at para.4.F.1.(a) using a plasma torch and spatter guard. Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

7) Clean to remove spatter bead from Inner Barrel/Head assy and Outer Barrel. Ensure no thinning of parent metal occurs.

Heat treat Inner Barrel/Head assy and Outer Barrel.

- 8) Clean to remove any traces of marking medium.
- 9) Heat treat at 1150°C ± 10°C in a vacuum for 30 minutes. Cool by rapid gas quench. NOTE: Outer Barrel heat treat may be reduced to 15 minutes.

Use suitable fixtures or restraint to maintain feature controls.

10) Inspect Outer Barrel and Inner Barrel/Head assy for excessive distortion and if necessary true-up using conventional hand tools. Refer to Figs. 417 to 420.

11) Machine Inner Barrel/Head assy.

Refer para.4.C.op's 8 to 11.

Machine Outer Barrel.

12) Locate the Outer Barrel on a surface table on the Rear Outer Flange. Mark a line 16.669 (423,39) from the Rear Outer Flange face circumferentially around barrel.

Refer to Fig.429. Use Omat 264 or similar.

13) Locate Outer Barrel to holding fixture and locate fixture assy on a vertical centre lathe and set true. Refer to para.7.Tools, item 1.

14) Machine Outer Barrel to 16.669 (423,39) dimension marked at para.4.F.13. Remove burrs.

Refer to Fig. 429.

15) Inspect to ensure dimension has been satisfactorily achieved. Refer to Fig. 429.

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16) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

17) Inspect Sermaloy J coating.

Refer para.4.B.op's 12 and 13.

Inspect Thermal Barrier coating.

18) Visually inspect the Thermal Barrier coating on the Inner Barrel/Head assy and Outer Barrel for condition.

19) If required, locally or completely remove coating. Ensure coating is removed for a distance of 0.250(6,35) from the weld joint. Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14 for removal method.

Produce No.3 Outer Cooling Ring/Outer Front Chamber Section Assy.

20) Withdraw from stores replacement No.3 Outer Cooling Ring and Outer Front Chamber Section.

Refer to Fig. 403 items -4 and -5.

21) Heat treat at 1150°C ± 10°C in a vacuum for 15 to 30 minutes.

Cool by rapid gas quench.

Refer to General Information.

- 22) Inspect components for excessive distortion and if necessary true-up using conventional hand tools.
- 23) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use Omat 583. Refer to TSD 594 OP.101.

24) Assemble the replacement Outer Front Chamber Section (ref.item -4) to the replacement No.3 Outer Cooling Ring (ref.item -5) using retaining strap. The edge closest to the plunged holes is the abutment face for the No.3 Outer Cooling Ring. Form the mating ends to ensure correct alignment using conventional tools.

Refer to Fig.402. Refer to para.7.Tools, item 21.

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| 25) | Tackweld, diametrically |
|-----|-------------------------------|
| | opposite the Outer Front |
| | Chamber Section to the No.3 |
| | Outer Cooling Ring using |
| | argon backing stand and head. |

Refer to Fig. 407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP. 409
using filler rods to Omat
3/62.

- 26) Remove retaining strap and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 27) Automatically weld the Outer Front Chamber Section/No.3
 Outer Cooling Ring assy with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

28) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

29) Visually inspect to ensure welding has been carried out satisfactorily.

Refer TSD 594 OP.409.

30) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Weld Outer Front Chamber/No.3 Outer Cooling Ring Assy to Outer Barrel.

31) If necessary expand and/or manipulate the mating parts to ensure correct match of respective diameters. Refer to para.7.Tools, items 4, 13, 14 and 15.

32) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use Omat 583. Refer to TSD 594 OP.101. 33) Assemble the Outer Front Chamber Section/No.3 Outer Cooling Ring Assy to the Outer Barrel using retaining strap. Ensure the longitudinal welds are in the correct angular position.

Refer to Fig. 408. Refer to para.7. Tools, item 25.

34) Tackweld, diametrically opposite, the Outer Front Chamber Section/No.3 Outer Cooling Ring Assy to the Outer Barrel using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

35) Remove retaining strap and roll weld tacks to finally remove any mismatch and to flatten the tacks.

36) Automatically weld the Outer Front Chamber Section/No.3 Outer Cooling Ring Assy/Outer Barrel with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

37) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

38) Visually inspect to ensure welding has been carried out satisfactorily.

Refer TSD 594 OP.409.

39) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Machine Outer Barrel.

40) Locate Outer Barrel to holding fixture and locate fixture assy on a vertical centre lathe and set true.

Refer to para.7.Tools, item 1.

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41) Machine Outer Barrel to 20.310 (515,87) dimension from the Rear Outer Flange face.
Remove burrs.

Refer to Fig. 412.

42) Inspect to ensure dimension has been satisfactorily achieved.

Refer to Fig. 412.

43) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Plasma spray Outer Barrel.

44) Plasma spray the No.3 Outer Cooling Ring (ref.item -5), adjacent Chamber Section (ref.item -4) and any areas where coating has been removed. Ensure weld joint area remains free of coating.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14.(Part 2). Do not mark the salvage number for Repair No.14. Refer to Fig.402.

45) Attach Outer Barrel to Inner Barrel/Head Assy.

Refer to para.4.C.op's 18 to 28.

Post Weld Heat Treatment.

- 46) Clean the Chamber to remove any traces of marking medium.
- 47) Position Chamber in a vacuum furnace.
 Heat treat at 800° C ± 5° C.
 Soak at this temperature for 8 hours.
 Cool by rapid gas quench.

Refer to para.7.Tools, item 16.

Produce Igniter Holes.

48) Locate the Chamber to holding fixture and locate fixture assy on a jig boring machine.

Refer to para.7.Tools, item 1.

49) Machine the 2 igniter holes at the positions shown.
Remove burrs and radius edge of each igniter hole.

Refer to Figs. 422 and 423.

50) Inspect to ensure dimensions have been satisfactorily achieved.

Refer to Figs. 422 and 423.

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- 51) Remove plasma spray from around inner surface of igniter holes to the required dimensions.
- 52) Locally dye penetrant inspect igniter hole positions.

Refer to Fig. 423.
Refer to Overhaul Manual
Chapter 72-41-01, Repair
No. 14 for removal method.

Refer TSD 594 OP.213.

ı



G. REPLACING THE REAR OUTER FLANGE.

1) Locate the Chamber on its front end on a surface table. Mark a line circumferentially around the Rear Outer Flange (ref.item -15) 0.200(5,08) from the weld line.

Refer to Fig. 402.

- Record all markings on the Rear Outer Flange for marking on the replacement Rear Outer Flange.
- 3) Locate the Chamber in holding fixture using packing to support the Inner Barrel. Separate the Flange by cutting circumferentially around the line marked at para.4.G.1. using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

- 4) Remove items from fixture.
- 5) Clean to remove spatter bead from the Chamber. Ensure no thinning of parent metal occurs.

Heat treat Chamber.

- 6) Clean to remove any traces of marking medium.
- 7) Heat treat at 1150° C \pm 10° C in a vacuum for 30 minutes. Cool by rapid gas quench.

Use suitable fixture or restraint to maintain feature controls.

8) Inspect the Chamber for excessive distortion and if necessary true-up using conventional hand tools. Refer to Figs. 417 to 420.

Machine the Chamber.

- 9) Locate the Chamber to a vertical centre lathe with Front Fairing down and set true.
- 10) Machine the Chamber back to the weld line. Remove burrs.

Refer to Fig. 430.

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11) Inspect to ensure dimension has been satisfactorily achieved.

Refer to Fig. 430.

12) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Weld replacement Rear Outer Flange to Chamber.

13) Withdraw from stores replacement Rear Outer Flange.

Refer to Fig. 403 item -15.

14) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use Omat 583. Refer to TSD 594 OP.101.

15) Assemble the replacement Rear Outer Flange to the Chamber using retaining strap. Form the mating ends to ensure correct alignment using conventional tools.

Refer to para.7.Tools, item 30.

16) Tackweld, diametrically opposite the Rear Outer Flange to the Chamber using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

- 117) Remove retaining strap and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 18) Automatically weld the Rear Outer Flange to Chamber with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

19) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

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20) Visually inspect to ensure welding has been carried out satisfactorily. Refer to TSD 594 OP.409.

21) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Post Weld Heat Treatment.

22) Clean the Chamber to remove any traces of marking medium.

23) Position Chamber in a vacuum furnace on the Front Fairing end. Heat treat at 800°C ± 5°C. Soak at this temperature for 8 hours.

Cool by rapid gas quench.

True-up Chamber.

24) True-up Chamber completely

Use conventional hand tools. Refer to Figs. 417 to 420.

25) Check that the Chamber has been trued-up satisfactorily. Refer to Figs. 417 to 420.

26) Dye penetrant inspect Chamber.

Finish machine Rear Outer Flange.

Refer to TSD 594 OP.213.

27) Locate Chamber to holding fixture and locate fixture

Refer to para.7.Tools, item 22.

fixture and locate fixture assy on a vertical centre lathe and set true.

Refer to Figs. 417 and 419.

28) Finish turn the Rear Outer Flange to the dimensions shown. No thinning of parent metal or grinding is permitted.

29) Remove burrs using a cutter or aluminium oxide scurf mop.

30) Inspect to ensure dimensions have been satisfactorily achieved. Refer to Figs. 417 and 419.

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Produce Holes and Apertures.

NOTE: Before commencement of machining, ensure the Chamber is set in relation to the engine horizontal centre line which can be found by its relationship to hole BH. (Ref.Fig.425).

- 31) Locate and clamp Chamber to a suitable jig boring machine.
- 32) Drill and ream 2 holes 0.1495 (3,80) diameter in the position of the 2 holes No 10(0.190)-32UNF-2B in the flange, either side of the horizontal centre line.

Refer to Fig. 424.

- 33) Remove Chamber from machine.
- 34) Locate Chamber to holding fixture, locating the dowels in the 2 holes produced at para.4.G.32. and locate fixture assy to a suitable jig boring machine.

Refer to para.7.Tools, item 23.

35) Produce the 0.900(22,86) diameter hole.

Refer to Figs. 422 and 423.

36) prill and mill to produce the 32 apertures.

Refer to Fig. 422.

- 37) Remove fixture assy from machine.
- 38) Locate and clamp Chamber to a suitable jig boring machine.
- 39) Open out the 2 holes produced at para.4.G.32. to produce 2 holes No.10(0.190)-32UNF-2B.

Refer to Fig. 424.

- 40) Remove Chamber from machine.
- 41) Remove any burrs using a cutter or aluminium oxide scurf mop. Thinning of parent metal or grinding is not permitted.

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42) Inspect to ensure the correct number of holes and apertures have been produced satisfactorily.

Refer to Figs 422 to 424.

43) Locally dye penetrant inspect machined locations.

Refer to TSD 594 OP.213.



H. REPLACING THE REAR INNER FLANGE.

1) Locate the Chamber on its front end on a surface table.

Mark a line circumferentially around the Rear Inner Flange (ref.item -18) 0.200(5,08) from the weld line.

Refer to Fig. 402.

- Record all markings on the Rear Inner Flange for marking on the replacement Rear Inner Flange.
- 3) Locate the Chamber in suitable holding fixture.
 Separate the Flange by cutting circumferentially around the line marked at para.4.H.1. using a plasma torch and spatter guard.

A mechanical cutter may be used as an alternative method if preferred.

- 4) Remove items from fixture.
- 5) Clean to remove spatter bead from the Chamber. Ensure no thinning of parent metal occurs.

Heat treat Chamber

- 6) Clean to remove any traces of marking medium.
- 7) Heat treat at 1150°C ± 10°C in a vacuum for 30 minutes. Cool by rapid gas quench.

Use suitable fixture or restraint to maintain feature controls.

8) Inspect the Chamber for excessive distortion and if necessary true-up using conventional hand tools. Refer to Figs.417 to 420.

Machine the Chamber.

- 9) Locate the Chamber to a vertical centre lathe with Front Fairing down and set true.
- 10) Machine the Chamber back to the weld line. Remove burrs.

Refer to Fig. 431.

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11) Inspect to ensure dimension has been satisfactorily achieved.

Refer to Fig. 431.

12) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Weld replacement Rear Inner Flange to Chamber.

13) Withdraw from stores replacement Rear Inner Flange.

Refer to Fig.403 item -18.

14) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease. Use Omat 583. Refer to TSD 594 OP.101.

15) Assemble the replacement Rear Inner Flange to the Chamber using retaining strap ensuring the 3 tooling holes are in the correct relationship to the Chamber vertical centre line (Datum C). Form the mating ends to ensure correct alignment using conventional tools.

Refer to Fig.432. Refer para.7.Tools, item 31.

16) Tackweld, diametrically opposite the Rear Inner Flange to the Chamber using argon backing stand and head. Refer to Fig. 407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP. 409
using filler rods to 0mat
3/62.

- 17) Remove retaining strap and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 18) Automatically weld the Rear Inner Flange to Chamber with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig. 407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP. 409
using filler rods to Omat
3/62.

19) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

20) Visually inspect to ensure welding has been carried out satisfactorily. Refer to TSD 594 OP.409.

21) Locally dye penetrant inspect weld location. Refer TSD 594 OP.213.

Post Weld Heat Treatment.

- 22) Clean the Chamber to remove any traces of marking medium.
- 23) Position Chamber in a vacuum furnace on the Front Fairing end. Heat treat at 800°C ± 5°C. Soak at this temperature for 8 hours. Cool by rapid gas quench.

True-up Chamber.

24) True-up Chamber completely using standard shop tools to achieve the required feature controls. Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

25) Check that the Chamber has been trued-up satisfactorily.

Refer to Figs.417 to 420.

26) Dye penetrant inspect Chamber.

Refer to TSD 594 OP.213.

Finish machine Rear Inner Flange.

27) Locate Chamber to holding fixture and locate fixture assy on a vertical centre lathe and set true. Refer to para.7.Tools, item 22.

28) Finish turn the Rear Inner Flange to the dimensions shown. No thinning of parent metal or grinding is permitted.

Refer to Figs. 417 and 420.

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| 29) | Remove burn | s using a | cutter or |
|-----|-------------|-----------|-----------|
| | aluminium o | xide scur | f mop. |

30) Inspect to ensure dimensions have been satisfactorily achieved.

Refer to Figs.417 and 420.

Produce Shank Nut/Dowel Holes.

31) Locate Chamber to holding fixture and clamp drilling template in position. Locate fixture assy onto a suitable radial drilling machine.

Refer to para.7.Tools, items 22 and 24.

32) Prill, ream, countersink and chamfer 16 holes equi-spaced. Refer to Figs. 425 and 426.

33) Drill and ream 4 holes.
3 holes equi-spaced as for 4 and 1 hole BG offset as shown.

Refer to Figs. 425 and 426.

- 34) Remove Chamber from fixture.
- 35) Remove any burrs using a cutter or aluminium oxide scurf mop. Thinning of parent metal or grinding is not permitted.
- 36) Inspect to ensure the correct number of holes have been produced satisfactorily.

Refer to Figs. 425 and 426.

37) Locally dye penetrant inspect machined locations.

Refer to TSD 594 OP.213.



- J. REPLACEMENT OF DAMAGED SECTIONS/RINGS GENERAL.
- 1) Locate Chamber on its flanged end on a surface table. Mark two lines circumferentially around the section or ring to be replaced at 0.200(5,08) from the weld line at each end.

Refer Fig.402. Use Omat 264 or similar.

- 2) Identify the Inner and Outer Barrels as a pair before cutting.
- 3) Locate the Chamber in holding fixture using packing to support the Inner Barrel. Separate the Chamber by cutting circumferentially around the upper line marked at para.4.J.1. using a plasma torch and spatter guard.

Refer to para.7. Tools, items 1 and 2. A mechanical cutter may be used as an alternative method if preferred.

- 4) Remove the Inner/Outer Barrel from fixture.
- 5) Cut circumferentially around the lower line marked at para.4.J.1. using a plasma torch and spatter guard with the appropriate holding fixture.

Refer to para.7.Tools, item 1 for Outer Chamber or item 17 for Inner Chamber. A mechanical cutter may be used as an alternative method if preferred.

- 6) Remove Chamber from fixture.
- 7) Clean to remove spatter bead from the Inner and Outer Barrels. Ensure no thinning of parent metal occurs.

Heat treat Inner/Outer Barrel assy's.

- Clean to remove any traces of marking medium.
- 9) Heat treat at 1150°C ± 10°C in a vacuum for 15 to 30 minutes.
 Cool by rapid gas quench.
 NOTE: Where Head Assy is involved heat treat must be 30 minutes.

Use suitable fixtures or restraint to maintain feature controls.

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10) Inspect Inner/Outer Barrel. for excessive distortion and if necessary, true-up using conventional hand tools. Refer to Figs.417 to 420.

11) Inspect for satisfactory separation of sections.

Machine Inner Barrel.

12) Locate the Inner Barrel to a surface table on the Inner Rear Flange (datum A). Mark the appropriate cut-off line.

Refer to Fig. 409. Use Omat 264 or similar.

- 13) Locate a holding fixture on a vertical centre lathe and locate the Inner Barrel to the fixture.
 - (a) If the Head assy is still attached to the Inner Barrel.

Refer to para.7.Tools, item 3.

(b) If the Head assy is not attached. Refer to para.7.Tools, item 17.

14) Turn to produce the cut-off dimension previously marked at para.4.J.12.

Remove burrs.

Refer to Fig. 409.

15) Inspect to ensure cut-off dimension has been satisfactorily achieved. Refer to Fig. 409.

16) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Machine Outer Barrel.

17) Locate the Outer Barrel on a surface table locating on the Outer Rear Flange. Mark the appropriate cut-off line. Refer to Fig.410. Use Omat 264 or similar.

18) Locate a holding fixture on a vertical centre lathe and locate the Outer Barrel to the fixture.

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(a) If the Head assy is still attached to the Outer Barrel.

Refer to para.7.Tools, item 3.

(b) If the Head assy is not attached.

Refer to para.7. Tools, item 1.

19) Turn to produce the cut-off dimension previously marked at para.4.J.17.
Remove burrs.

Refer to Fig. 410.

20) Inspect to ensure cut-off dimension has been satisfactorily achieved. Refer to Fig. 410.

21) Inspect Sermaloy J coating.

Refer to para.4.B.op's 12 and 13.

Inspect Thermal Barrier coating.

- 22) Visually inspect the Thermal Barrier coating on the Inner/ Outer/Barrel/Head assy and Inner/Outer Barrel for condition.
- . 23) If required, locally or completely remove coating.
 Ensure coating is removed for a distance of 0.250(6,35) from the weld joint.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14 for removal method.

24) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Weld replacement section to Barrel.

NOTE: If items -6 and -7, or items -26 and -27 are to be replaced at the same time, an item -6/-7 assembly or an item -26/-27 assembly can be produced, plasma sprayed, and then replaced as one part.

25) Withdraw from stores a replacement ring or section.

Refer to Figs.402 to 404.

26) Heat treat at 1150°C ± 10°C in a vacuum for 15 to 30 minutes.

Cool by rapid gas quench.

Refer to General Information.

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- 27) Inspect components for excessive distortion and if necessary true-up using conventional hand tools.
- 28) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use Omat 583. Refer to TSD 594 OP.101.

29) Assemble the replacement ring or section to the Barrel using retaining strap (where applicable), ensuring the longitudinal welds are in the correct angular position. Form the mating ends to ensure correct alignment using conventional tools.

Refer to Figs 402 and 408. Refer to para.7.Tools, items 25 to 31.

30) Tackweld diametrically opposite, the replacement ring or section to the Barrel using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

- 31) Remove retaining strap (if fitted) and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 32) Automatically weld the Barrel /section assy with a fully penetrating single-sided weld on a welding table using argon backing stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

33) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

34) Visually inspect to ensure welding has been carried out satisfactorily.

Refer TSD 594 OP.409.

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35) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Plasma spray.

36) Plasma spray repaired areas as instructed.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.14.(Part 2). Do not mark the salvage number for Repair No.14.

Machine Inner/Outer Barrel assy.

37) Locate the Barrel assy to a holding fixture and locate fixture assy on a vertical centre lathe and set true.

(a) For Inner Barrel assy

Refer to para.7.Tools, item 17.

(b) For Outer Barrel assy

Refer to para.7.Tools, item 1.

38) Machine the Barrel assy to length. Remove burrs.

Refer to Figs. 409 and 410.

39) Inspect to ensure dimension has been satisfactorily achieved. Refer to Figs. 409 and 410.

40) Locally dye penetrant inspect machined location.

Refer TSD 594 OP.213.

Attach Barrel assy to Chamber/Head assy.

41) If necessary expand the Barrel assy to obtain the correct match with the Chamber/Head assy.

(a) For Inner Barrel assy.

Refer to para.7.Tools, items 4 to 7.

(b) For Outer Barrel assy.

Refer to para.7.Tools, items 4, 13, 14, and 15.

42) Clean the mating surfaces using clean fine grade abrasive mat and locally degrease.

Use Omat 583. Refer to TSD 594 OP.101.

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43) Assemble the Inner Barrel assy to the Outer Barrel assy using welding fixture with adapter set fitted. Ensure the longitudinal welds are in the correct position.

Refer to Fig.408.
Refer to para.7.Tools,
items 8 and 9.

NOTE: The Inner Barrel must be located in the fixture using the four dowel holes on rear face. (Refer to Fig.426). The Outer Barrel is located using fixture location pin engaged in the 0.900(22,86) hole in the rear flange. (Refer to Fig.423). It may be necessary to shim under the vaporiser location positions to remove any slight swash present and achieve a good mating fit at joint faces. Shimming is permitted up to a maximum of 0.030(0,76) at any one position and care must be taken not damage the Head assy outer skin.

44) Tackweld, diametrically opposite the Inner/Outer Barrel to the Chamber/Head assy using argon backing stand and head.

Refer to Fig. 407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP. 409
using filler rods to Omat
3/62.

- 45) Remove from fixture and roll weld tacks to finally remove any mismatch and to flatten the tacks.
- 46) Automatically weld the Inner/
 Outer Barrel to Chamber/Head
 assy with a fully penetrating
 single-sided weld on a welding
 table using argon backing
 stand and head.

Refer to Fig.407.
Refer to para.7.Tools,
items 11 and 12.
Refer to TSD 594 OP.409
using filler rods to Omat
3/62.

47) Visually inspect weld protrusion. Weld protrusion to be 0.025(0,63) max. Weld may be dressed, if necessary using either a cutter, aluminium oxide scurf mop or by rolling. Thinning of parent material or grinding is not permitted.

Refer to TSD 594 OP.409.

48) Visually inspect to ensure welding has been carried out satisfactorily and 2.650/2.710 (67,31/68,83) dimension has been achieved.

Refer TSD 594 OP.409. Refer to Figs.405, 406 and 417.

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72-41-01 Repair No. 27 Page 443 Jun 1/97 49) Locally dye penetrant inspect weld location.

Refer TSD 594 OP.213.

Post Weld Heat Treatment.

- 50) Clean the Chamber to remove any traces of marking medium.
- 51) Generally true-up Chamber using standard shop tools to achieve the required feature controls.

Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

52) Locate Chamber to heat treatment support ring and place Chamber/fixture assy in a vacuum furnace.

Refer to para.7.Tools, item 16.

53) Heat treat at 800°C ± 5°C.
Soak at this temperature for 8 hours.
Cool by rapid gas quench.

True-up Chamber.

54) True-up Chamber completely using standard shop tools to achieve the required feature controls.

Refer to Figs.417 to 420. Refer to para.2. Repair Limitations.

55) Check that the Chamber has been trued-up satisfactorily.

Refer to Figs.417 to 420.

56) Dye penetrant inspect Chamber.

Refer to TSD 594 OP.213.

Final machining.

NOTE: Operations 57 to 62 are only applicable if item -14 has been replaced.

57) Locate Chamber to holding fixture. Remove the outer support pillars to give access for machining. Locate the fixture assy to a suitable horizontal boring machine.

Refer to para.7.Tools item 22.

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58) Produce the 64 holes 1.250 (31,75) diameter. Ensure holes are positioned correctly in relation to longitudinal weld joint and datum C.

Refer to Fig. 433.

- 59) Remove Chamber from fixture.
- 6D) Remove any burrs using a cutter or aluminium oxide scurf mop. Thinning of parent metal or grinding is not permitted.
- 61) Inspect to ensure the holes have been produced satisfactorily.

Refer to Fig. 433.

62) Locally dye penetrant inspect machined holes.

Refer to TSD 594 OP.213.

NOTE: Operations 63 to 68 are only applicable if item -19 has been replaced.

63) Locate Chamber to holding fixture with adapter set fitted. Locate fixture assy to a suitable jig boring machine and set true.

Refer to para.7.Tools, items 8 and 9.

64) Produce the 60 holes 0.875 (22,22) diameter. Relationship of holes to any other feature is not important.

Refer to Fig. 434.

- 65) Remove Chamber from fixture.
- 66) Remove any burrs using a cutter or aluminium oxide scurf mop. Thinning of parent metal or grinding is not permitted.
- 67) Inspect to ensure the holes have been produced satisfactorily.

Refer to Fig. 434.

68) Locally dye penetrant inspect machined holes.

Refer to TSD 594 OP.213.

K. ASSEMBLE VAPORISERS.

 Withdraw from stores, Pins, serviceable Vaporisers and Retaining Nuts previously removed and Rivets. Refer to para.8.Replacement Parts, items -36 to -39.

2) Shrink-fit the 32 Pins in position at the 16 vaporiser locations as shown. Refer to Fig. 434.

 Assemble the 16 off Vaporisers, Nuts and Rivets. Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the salvage number for Repair No.8.

L. INSTALL THE SHANK NUTS.

 Withdraw new Shank Nuts from stores. Refer to para.8.Replacement Parts, item -35.

2) Locate the Shank Nuts progressively to Rear Flange and swage over into the countersunk holes. Refer to Fig.426. Refer to Overhaul Manual Chapter 72-09-00 Repair.

3) Inspect to ensure satisfactory installation of Shank Nuts.

Refer to Overhaul Manual Chapter 72-09-00 Repair.

M. <u>IDENTIFY</u>.

1) Mark Repair Instruction number or R27 with relevant suffix adjacent to the normal assembly number using the vibro-percussion engraving technique. Refer to Overhaul Manual Chapter 72-09-00 Repair. Refer to Figs.401, 403 and 404.



5. MATERIAL

| COMPONENT | <u>MATERIAL</u> | <u>RR CODE</u> |
|--------------------|-----------------|----------------|
| CHAMBER, ASSEMBLY, | C263 | 0.411 |
| COMBUSTION. | MSRR 7038 | QAU |
| | MSRR 7036 | QAR |

6. DATA

NONE.

7. <u>TOOLS</u>

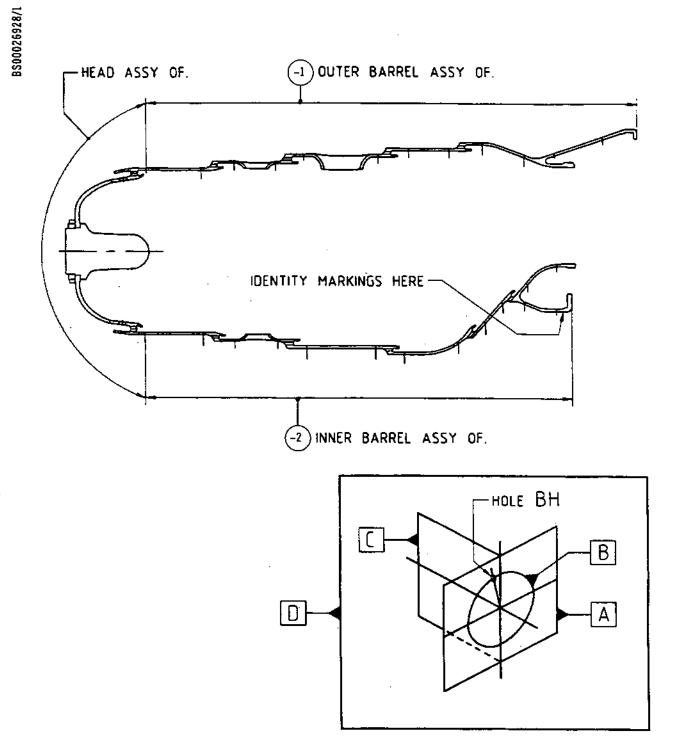
| TOOL NUMBER | DESCRIPTION QL | <u>JANTITY</u> | <u>ITEM</u> |
|----------------------|---------------------|----------------|-------------|
| S3S15231000 | Holding Fixture | 1 | 1 |
| S3S15919000 | Anti-spatter Guard | 1 | 2 3 |
| S3S15924000 | Index Fixture | 1 | 3 |
| S3S12769000 | Tapered Plug | 1 | 4 |
| S3S12777D01 | Wedge Former | 12 | 5 |
| S3S12777002 | Wedge Former | 12 | 5 6 7 |
| S3S12800000 | Restraining Ring | 1 | 7 |
| S3S12431000 | Welding Fixture | 1 | 8 |
| \$3\$15910000 | Adapter Set | 1 | 9 |
| S3S15936000 | Container | 1 | 10 |
| S3S12445000 | Argon Backing Stand | 1 | 11 |
| S3S12446000 | Argon Backing Head | 1 | 12 |
| S3S12770000 | Wedge Segment | 12 | 13 |
| \$3\$12772000 | Expanding Former | 16 | 14 |
| S3S12771000 | Restraining Ring | 1 | 15 |
| S3S12439000 | H/T Support Ring | 1 | 16 |
| S3S12437000 | Holding Fixture | 1 | 17 |
| S3S15525000 | Retaining Strap | 1 | 18 |
| S3S12434000 | Drill Jig | 1 | 19 |
| S3S12458000 | Drill Jig | 1 | 20 |
| S3S15526000 | Retaining Strap | 1 | 21 |
| S3S12432000 | Holding Fixture | 1 | 22 |
| S3S15649000 | Holding Fixture | 1 | 23 |
| S3S12459000 | Drilling Fixture | 1 | 24 |
| S3S15532000 | Retaining Strap | 1 | 25 |
| \$3\$15533000 | Retaining Strap | 1 | 26 |
| S3S15534000 | Retaining Strap | 1 | 27 |
| S3S15535000 | Retaining Strap | 1 | 28 |
| \$3\$15536000 | Retaining Strap | 1 | 29 |
| S3S15648000 | Retaining Strap | 1 | 30 |
| \$3\$15689000 | Retaining Strap | 1 | 31 |

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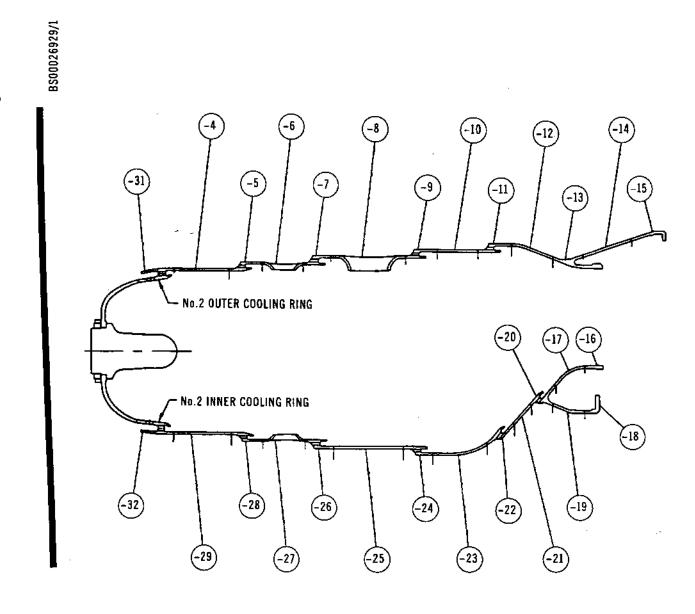
8. REPLACEMENT PARTS

| PART NUMBER | DESCRIPTION | QUANTITY | DASH ITEM |
|-------------|------------------------------|----------|----------------|
| в516667 | Section, Flame Tube, Outer | A/R) | -1 |
| B507010 | Section, Flame Tube, Outer | A/R) | |
| в516668 | Section, Flame Tube, Inner | A/R) | -2 |
| B507009 | Section, Flame Tube, Inner | A/R) | |
| B517494 | Section, Chamber, Combustion | A/R | -4 |
| B497193 | Ring, Cooling | A/R | - 5 |
| B517495 | Section, Chamber, Combustion | A/R | -6 |
| B497197 | Ring, Cooling | A/R | -7 |
| B517496 | Section, Chamber, Combustion | A/R | -8 |
| B495726 | Ring, Cooling | A/R | -9 |
| B517497 | Section, Chamber, Combustion | A/R | -10 |
| B495728 | Ring, Cooling | A/R | -11 |
| B517498 | Section, Chamber, Combustion | A/R | -12 |
| B517499 | Section, Chamber, Combustion | | -13 |
| B517500 | Section, Chamber, Combustion | A/R | -14 |
| B517501 | Flange, Outer | A/R | -15 |
| B517502 | Section, Chamber, Combustion | | -16 |
| B517503 | Section, Chamber, Combustion | | -17 |
| B517504 | Flange, Inner | A/R | -18 |
| B517505 | Section, Chamber, Combustion | | -19 |
| B481196 | Ring, Cooling | A/R | -20 |
| B517506 | Section, Chamber, Combustion | A/R | -21 |
| B481195 | Ring, Cooling | A/R | -22 |
| B517507 | Section, Chamber, Combustion | A/R | -23 |
| B495737 | Ring, Cooling | A/R | -24 |
| B517510 | Section, Chamber, Combustion | A/R | -25 |
| B497199 | Ring, Cooling | A/R | -26 |
| B517511 | Section, Chamber, Combustion | | -27 |
| B497195 | Ring, Cooling | A/R · | -28 |
| B517512 | Section, Chamber, Combustion | | -29 |
| B517513 | Extension, Scoop, Inner | A/R | -32 |
| B517514 | Extension, Scoop, Outer | A/R | -31 |
| AS20669 | Pin | 32 | -38 |
| B499243 | Vaporiser | A/R | -36 |
| B495785 | Retaining Nut | A/R | -37 |
| AS16258 | Rivet | 16 | -39 |
| AS27871 | Shank Nut | 16 | -35 |



TYPICAL SECTION THROUGH COMBUSTION CHAMBER ASSY. FIG. 401.

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TYPICAL SECTION THROUGH COMBUSTION CHAMBER ASSY. Fig. 402.

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IDENTITY CHART

| R.I. Number | REPAIR NUMBER | ASSEMBLY OF REPLACED | STANDARD ASSEMBLY AND PARTS REQUIRED |
|----------------|------------------|-------------------------|---|
| B517456 | R27A | -1 | B516667 OR B507010 |
| B517457 | R27B | -2 | B516668 OR B507009 |

| R.I. Number | REPAIR NUMBER | DASH ITEM Replaced | REPAIR PART REQUIRED |
|----------------|------------------|-----------------------|-------------------------|
| B517458 | R27C | -4 | B517494 |
| B517459 | R27D | -5 | B497193 |
| B517460 | R27€ | -6 | B517495 |
| B517461 | R27F | -7 | B497197 |
| B517462 | R27G | -8 | B517496 |
| B517463 | R27H | -9 | B495726 |
| B517464 | R27J | -10 | B517497 |
| B517465 | R27K | -11 | B495728 |
| B517466 | R27L | -12 | B517498 |
| B517467 | R27M | -13 | B517499 |
| B517468 | R27N | -14 | B517500 |
| B517469 | R27P | -15 | B517501 |
| B517470 | R27Q | -16 | B517502 |
| B517471 | R27R | -17 | B517503 |
| B517472 | R27S | -18 | B517504 |
| B517473 | R27T | -19 | B517505 |
| B517474 | R27U | -20 | B481196 |
| B517475 | R27V | -21 | B517506 |
| B517476 | R27W | -22 | B481195 |

FIG.403.

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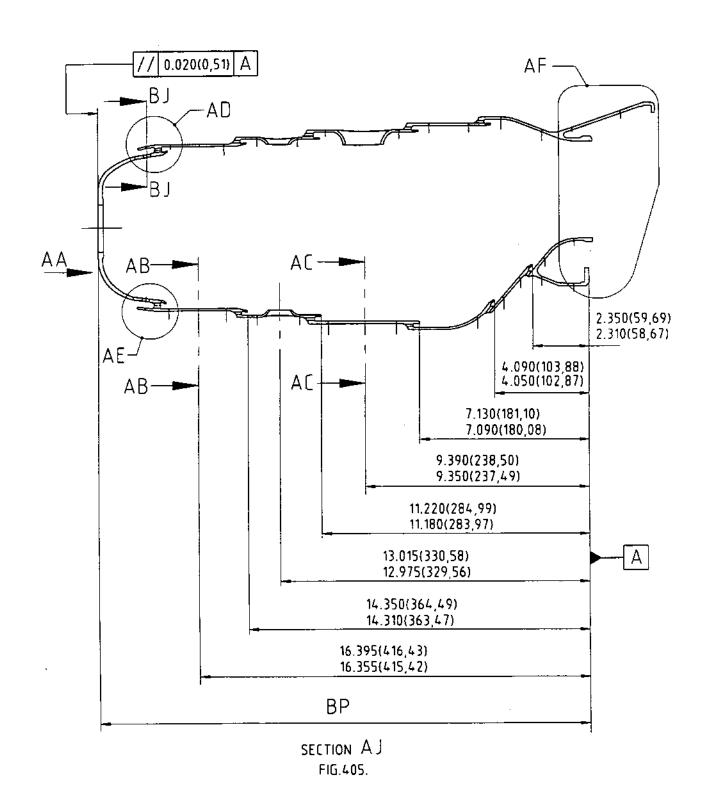
IDENTITY CHART

| R.I. Number | REPAIR NUMBER | SECTION REPLACED | REPAIR PART REQUIRED |
|----------------|------------------|---------------------|-------------------------|
| B517477 | R27X | -23 | B517507 |
| B517478 | R27Y | -24 | B495737 |
| B517479 | R27Z | -25 | B517510 |
| B517480 | R27AA | -26 | B497199 |
| B517481 | R27AB | -27 | B517511 |
| B517482 | R27AC | -28 | B497195 |
| B517483 | R27AD | -29 | B517512 |
| B517484 | R27AE | -32 | B517513 |
| B517485 | R27AF | -31 | B517514 |
| B517486 | | | |
| B517487 | | | |
| B517488 | | | |
| B517489 | | | |
| B517490 | | | |
| B517491 | | | |
| B517492 | | _ | |
| B517493 | | | |

R.I. NUMBERS B517486-93 NOT CURRENTLY ALLOCATED

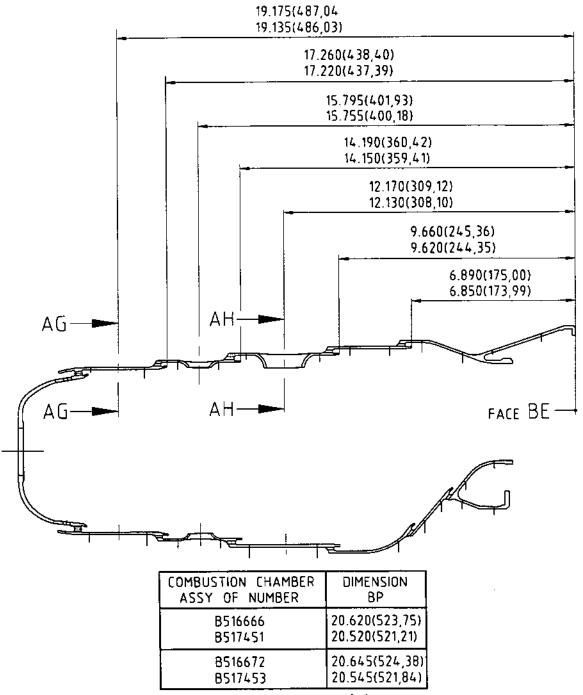
FIG.404.

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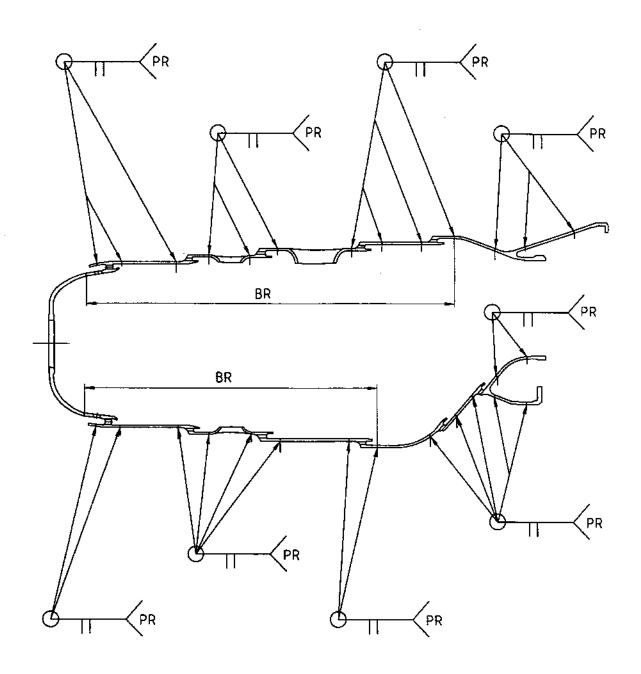
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REPEAT SECTION AJ

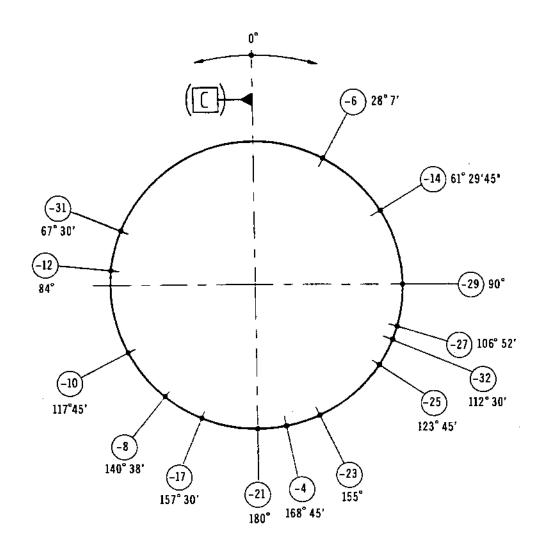
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SECTION SHOWING WELD SYMBOLS FIG.407.

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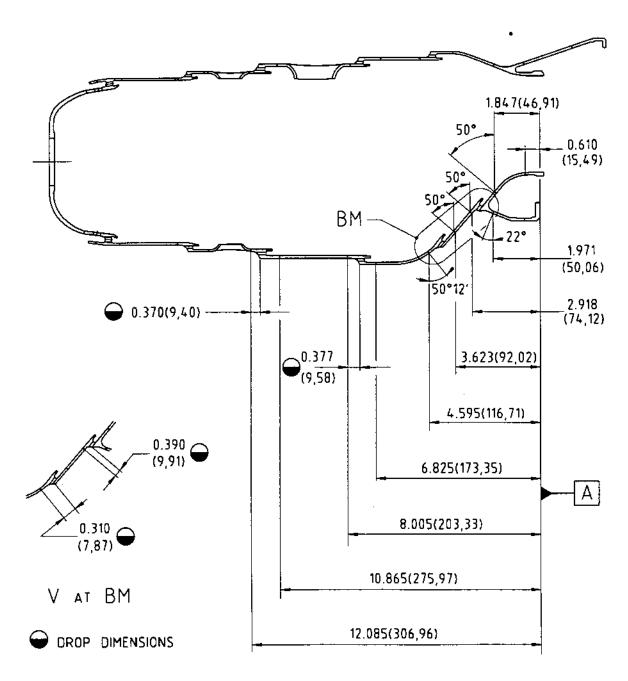


DIAGRAMMATIC VIEW ON AA ROTATED THROUGH 11°15' SHOWING ANGULAR POSITIONS OF LONGITUDINAL WELDS IN THE ABOVE ITEMS. NOTE:- ITEMS WITH 2 OR MORE WELDS MAY HAVE EITHER WELD IN POSITION SHOWN.

FIG.408.

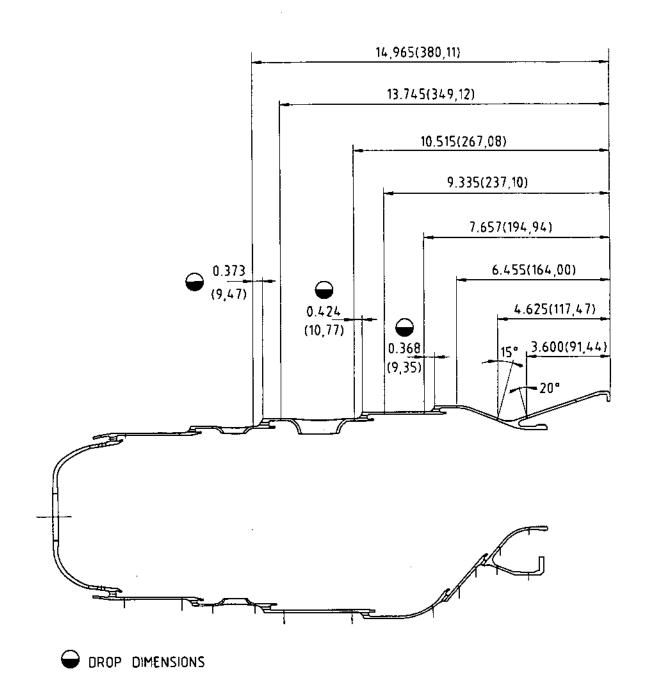
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CUT-OFF AND DROP DIMENSIONS - INNER BARREL FIG.409.

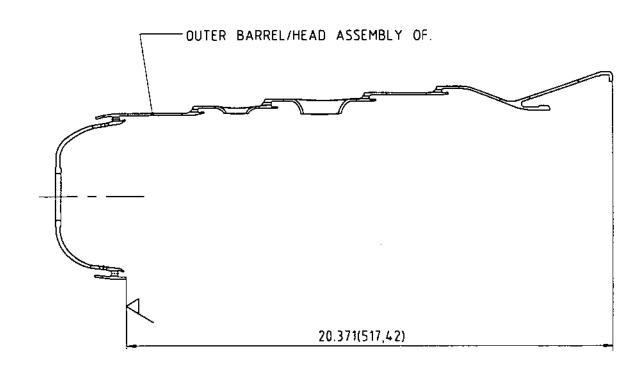
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CUT-OFF AND DROP DIMENSIONS - OUTER BARREL FIG.410.

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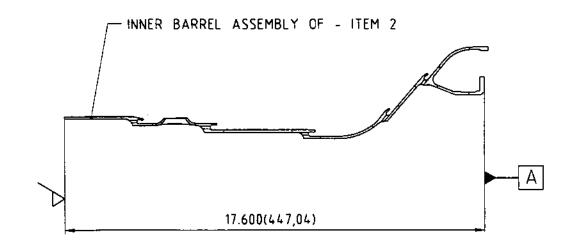
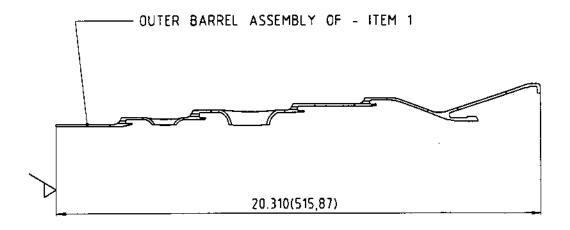


FIG.411.





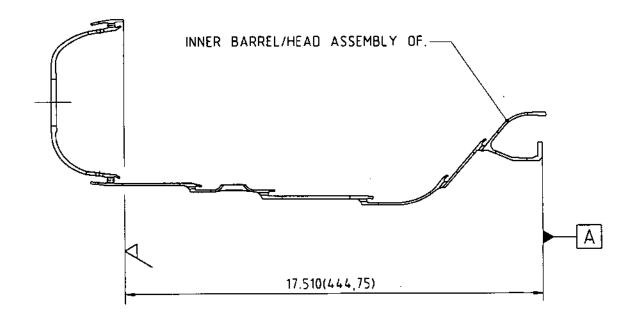
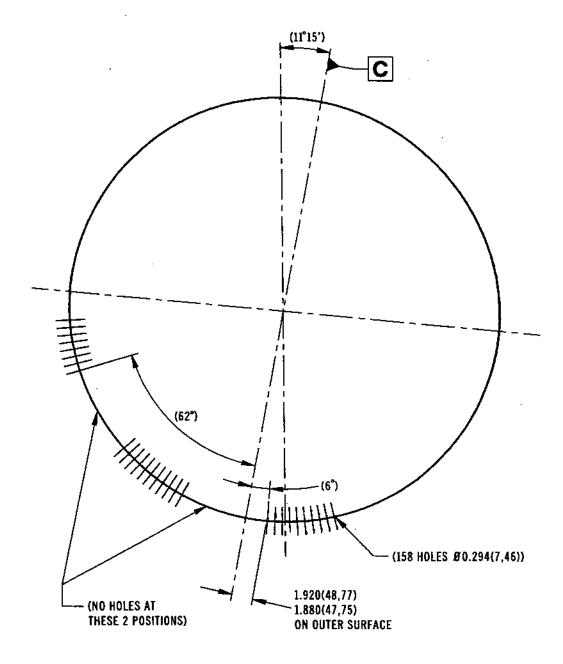


FIG.412.

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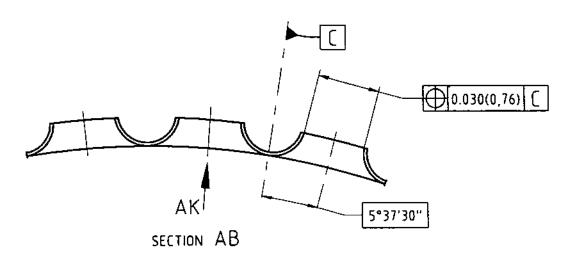
BS00028130/1



SECTION BJ FIG.413.

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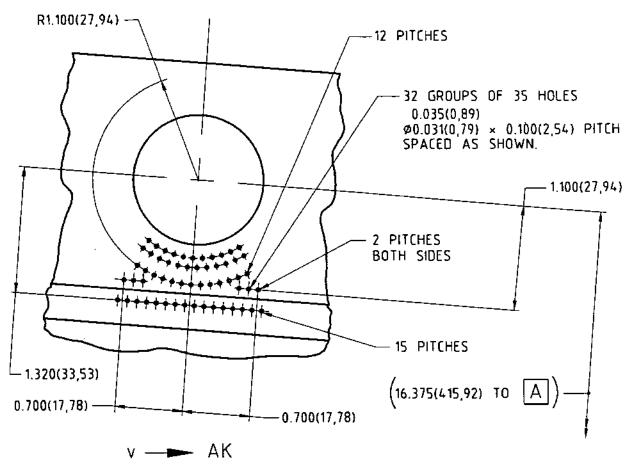
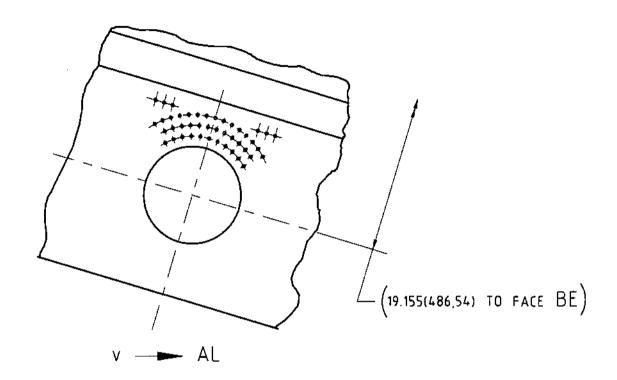


FIG.414.

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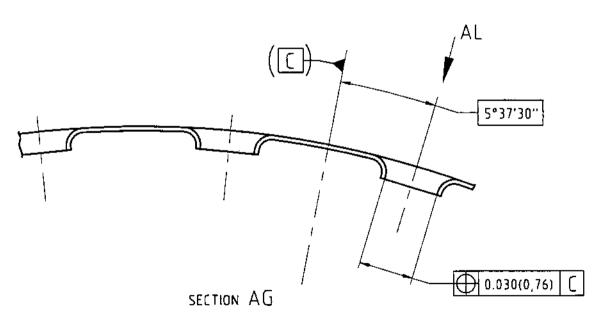


FIG.415.

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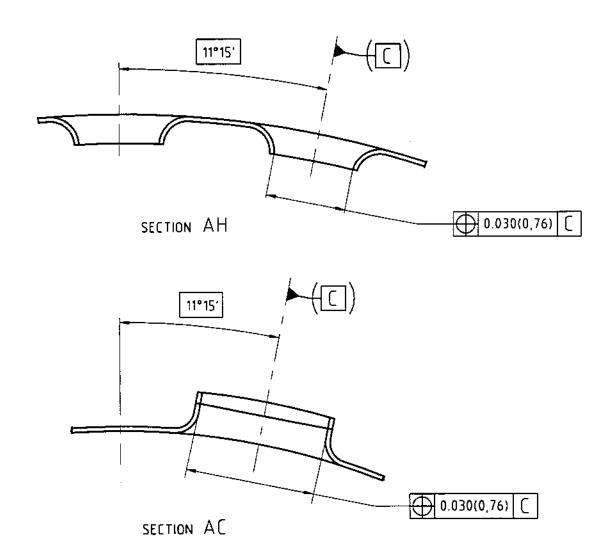
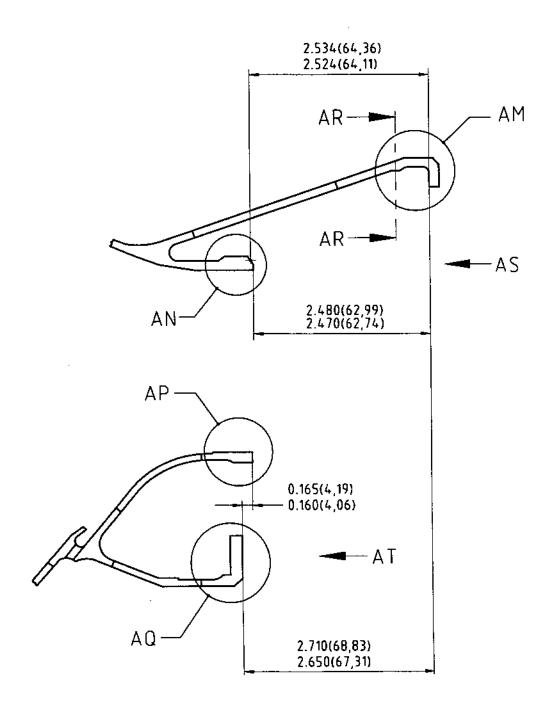
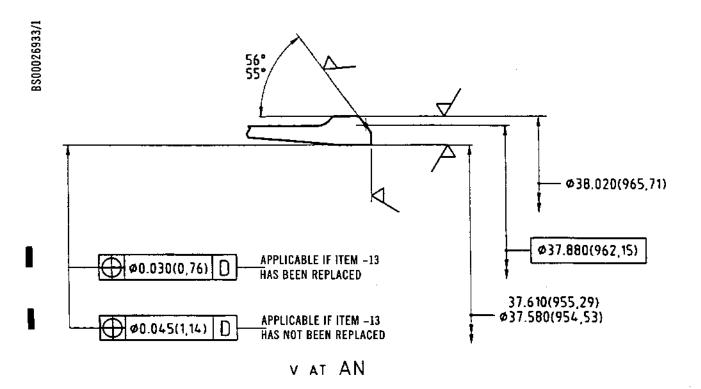


FIG.416.



VIEW AT AF





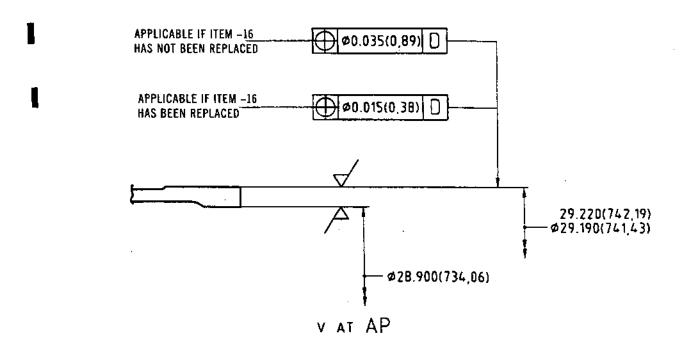
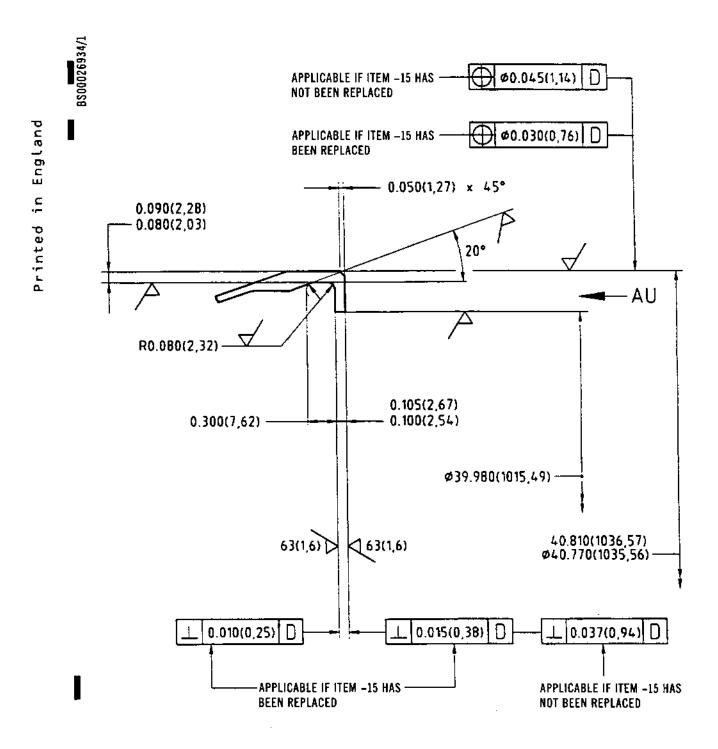


FIG.418.

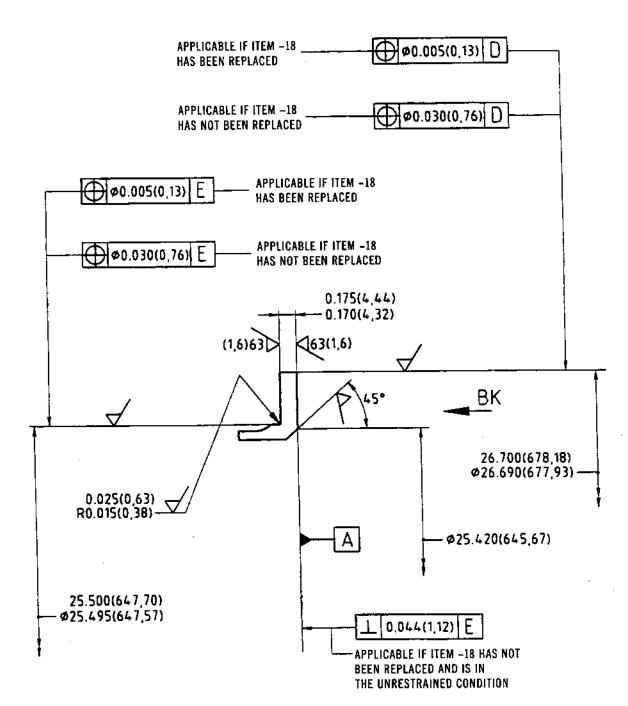
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VIEW AT AM FIG.419.

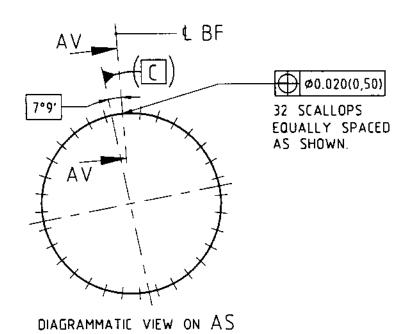
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V AT A.Q. FIG.420.

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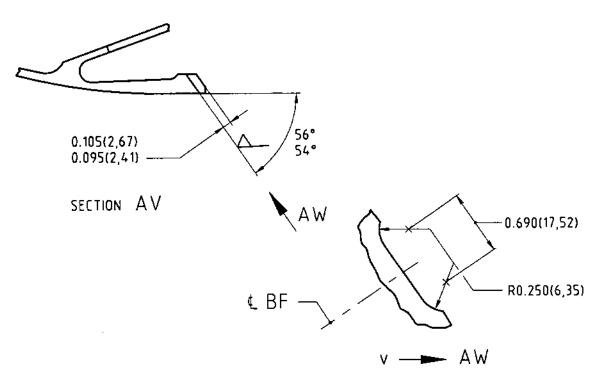
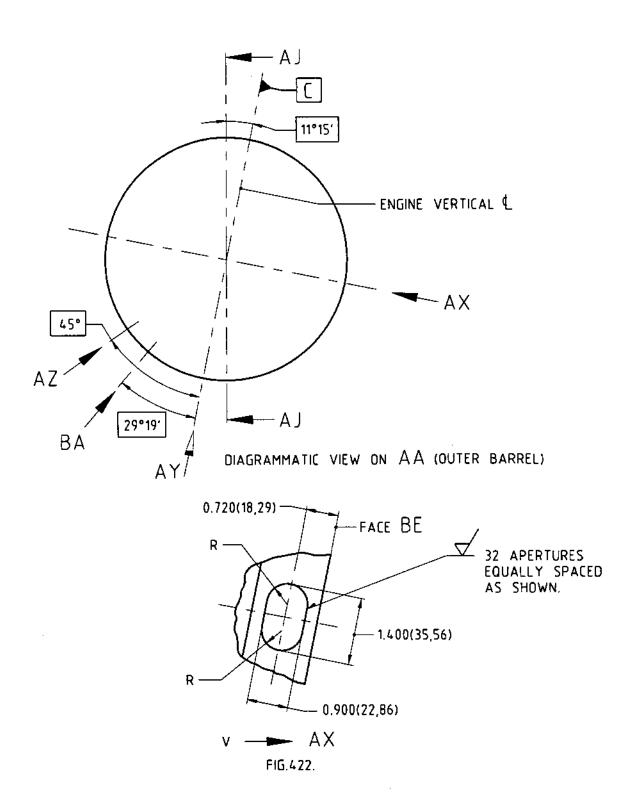


FIG.421.

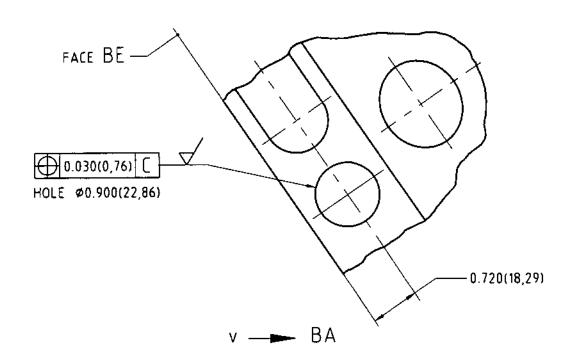
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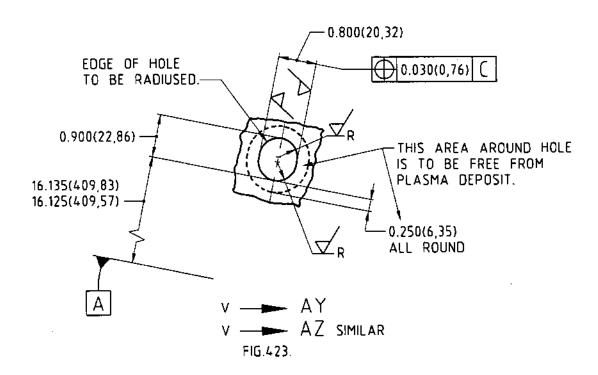




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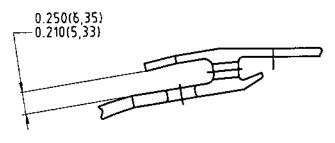




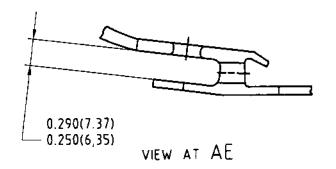


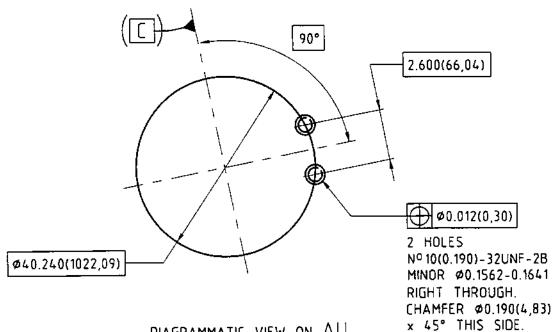
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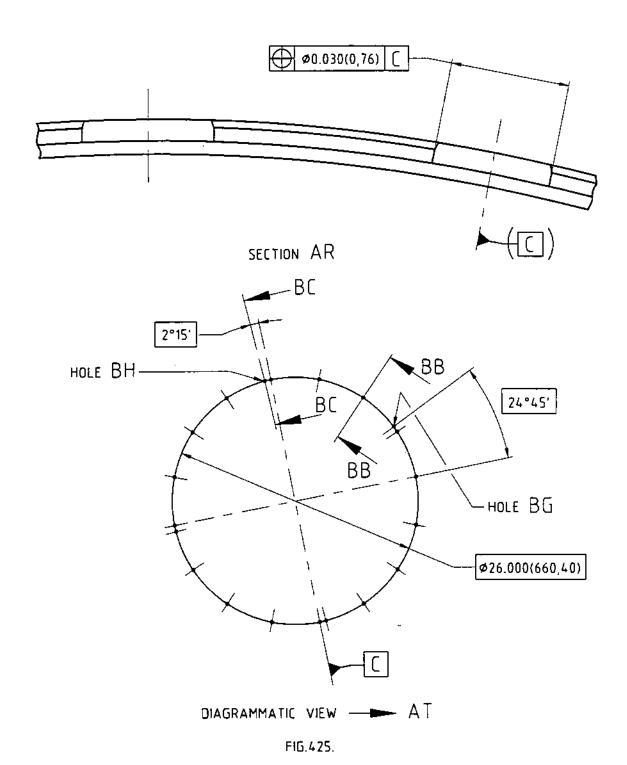
VIEW AT AD





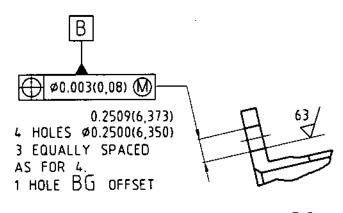
DIAGRAMMATIC VIEW ON AU FIG. 424.

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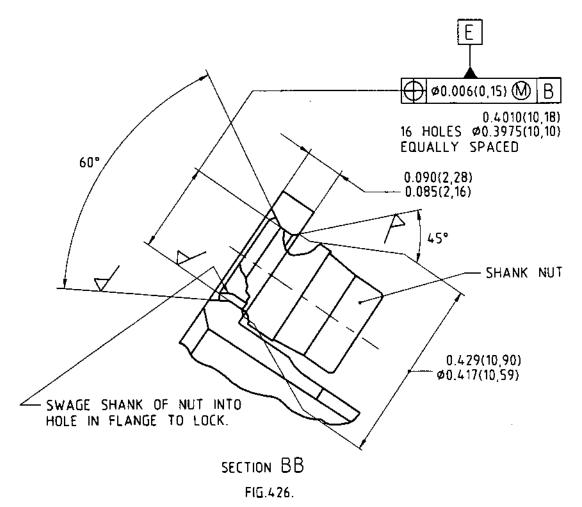


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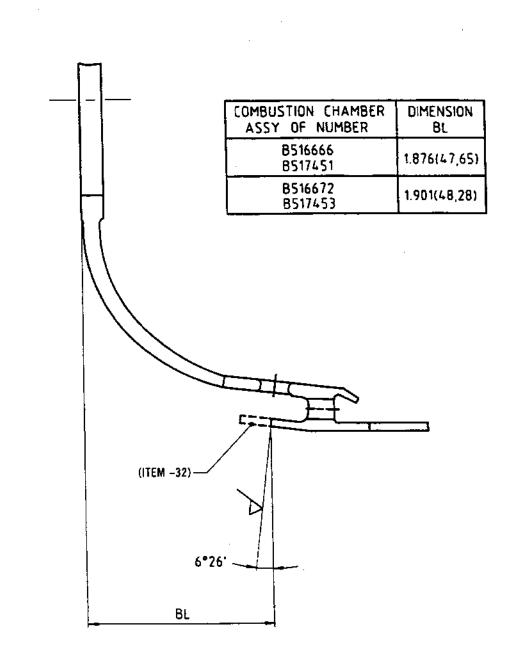




SECTION BC



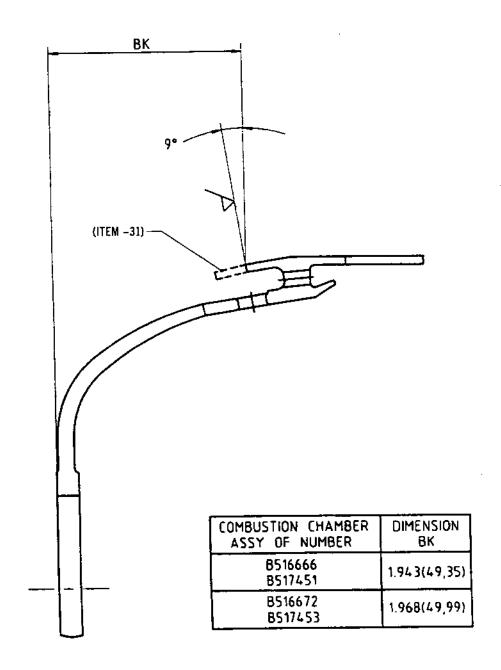
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REMOVAL OF EXISTING INNER SCOOP FIG.427.

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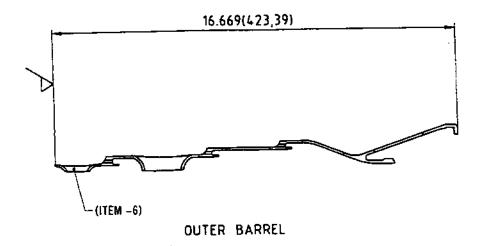


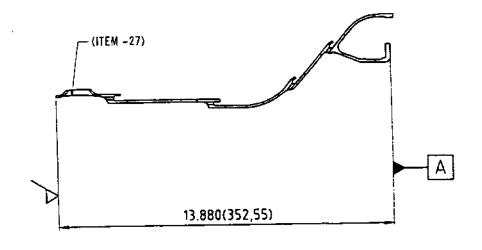


REMOVAL OF EXISTING OUTER SCOOP FIG.428.

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Printed in England



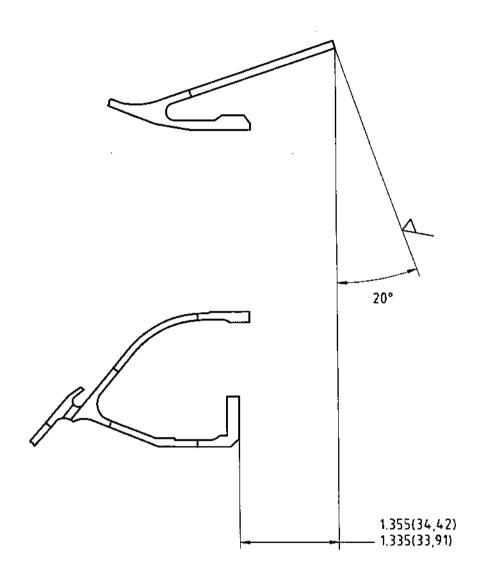


INNER BARREL

MACHINING OF INNER AND OUTER BARRELS FIG.429.

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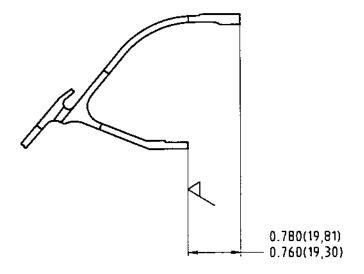




REAR OUTER FLANGE CUT-OFF DIMENSIONS FIG.430.

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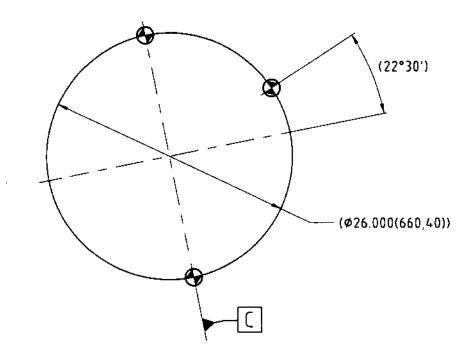




REAR INNER FLANGE CUT-OFF DIMENSIONS FIG. 431.



0.251(6,37)
3 TOOLING HOLES Ø0.250(6,35)
SPACED AS SHOWN

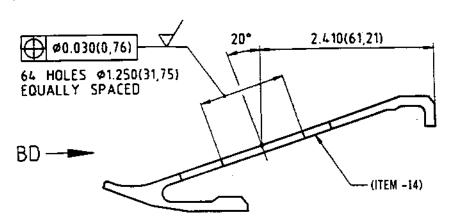


REPEAT DIAGRAMMATIC VIEW - AT

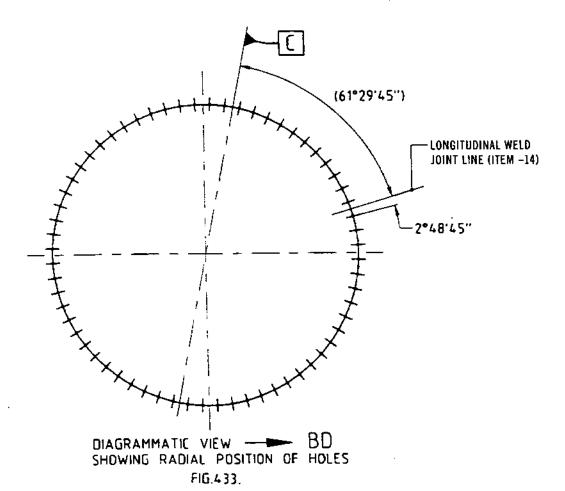
FIG.432.

printed in England

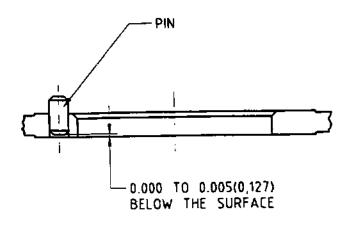
BS00026939/1



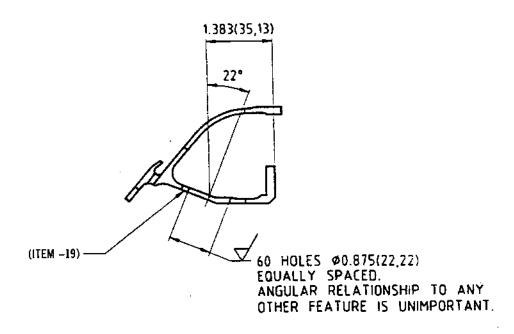
TYPICAL SECTION THROUGH HOLE



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SECTION THROUGH VAPORISER LOCATION



TYPICAL SECTION THROUGH HOLE FIG.434.

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CHAMBER, ASSEMBLY, COMBUSTION

RESTORATION OF THE OUTER BARREL H.P.N.G.V. LOCATION FACE BY REACTIVE DIFFUSION BRAZING

B517775

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|---------------|--------------------|
| 72-41-01 | 2 10N | в938173 |
| | 2 10R | B512865 |
| | 2 10s | B513927 |
| | 2 1 0T | B514702 B514706 |
| • | 2 10U | B516665 B517450 |
| | 2 10V | B516671 B517452 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this Repair Process shall be achieved without deviation. Where a need to deviate is considered necessary reference shall be made to the Repair Authority for agreement.

This instruction gives the procedure for restoration of the outer barrel H.P.N.G.V. Location face by reactive diffusion brazing on the Chamber, Assy, Combustion.

A test sample is required for validation purposes prior to the initial repair and any subsequent change of process, sub-contractor or locality. Details of the validation test requirements should be obtained by writing to the Repair Authority at Rolls-Royce Plc.



3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 (0,1) to 0.020 (0,5)
Machine where marked
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. Remove Vaporisers
- 1) Remove the 16 off Vaporisers as instructed.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the salvage number for Repair No.8.

- 2) Remove the 32 off Vaporiser locating pins, taking care not to damage the holes.
- Use hand held tools.

- B. Remove Shank Nuts
- Remove the self-locking Shank Nuts from the rear flange, taking care not to damage the flange.

Refer Overhaul Manual Chapter 72-09-00 Repair.

- C. Examine the Part
- Do a visual inspection of the part to ensure satisfactory removal of Vaporisers and Shank Nuts.



- D. <u>Penetrant Crack Test</u>
- 1) Do a penetrant crack test on the repair area(s).

Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-002. Use OMat 653 Fluorescent penetrant Medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

- E. Remove the damage
- 1) Remove high metal from fretted area(s).

3

Use hand held tools.

- F. Clean the Part
- 1) Remove the grease.

Refer to TASK 70-00-00-100-101 SUBTASK 70-00-00-110-101-001. Use degreasing equipment.

- G. Prepare for Brazing
- 1) Prepare surface for brazing.

Refer to Sochata (SNECMA) Brazing Process RBD NO.61.

- H. Mask the Part
- Put mechanical masks and/or stopping-off paint on the areas not to be brazed.

Use locally made mechanical masks or use OMat 3/122 Stopping-off paint.

- J. Braze the Part
- Apply "Sinter RBD" (high temperature braze) to fretted Outer Barrel H.P.N.G.V. location face.

Refer to Sochata (SNECMA) Brazing Process RBD NO.61 Braze between 1175 to 1185 Deg.C (2147 to 2165 Deg.F) for 30 minutes. Use vacuum/argon atmosphere furnace. Refer to Fig.402.

NOTE: Ensure sufficient braze to allow for final machining.

REPAIR



- K. Examine the Part
- Do a visual inspection of the Refer to Fig. 402.

NOTE: Ensure sufficient braze for final machining.

- L. Dimensionally inspect
- Do a dimensional inspection of the part.

Use standard inspection equipment.
Refer to Fig. 406 and 407.

- M. True-up flanges if necessary
- Generally true-up Combustion Chamber Assy to achieve the required dimensions.

Refer to Fig. 406 and 407.

- N. Penetrant Crack Test
- Do a penetrant crack test on the part.

Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-001. Use OMat 653 Flourescent penetrant Medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

- O. Inspect Sermoloy J coating
- Do a visual inspection of the Sermaloy J Coating on the Front Fairing for condition.
- P. Repair damage to Sermaloy J coating (if necessary)
- If necessary, repair damage using procedure specified.

Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.19. Do not mark the Salvage Number for Repair No.19.

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Repair No. 28
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- Q. Heat treat the Part
- 1) Heat treat the part.

Refer to TASK 70-00-00-300-409 SUBTASK 70-00-00-370-409-014. Heat in Vacuum or Argon to between 795 to 805 deg.C. (1463 to 1481 deg.F.) for 8 hours. Use vacuum/argon atmosphere furnace. Use suitable fixture(s) or restraint to maintain feature controls.

2) Cool part.

Cool by rapid gas quench.

- R. Penetrant Crack Test
- 1) Do a penetrant crack test on the part.

Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-001. Use OMat 653 Flourescent penetrant Medium sensitivity, Cracks are not permitted. Use penetrant crack test equipment.

- S. <u>Inspect the Thermal Barrier coating</u>
- Do a visual inspection of the Thermal Barrier coating on the Outer Barrel/Head assy and Inner Barrel for condition.
- T. Repair/replace Thermal Barrier coating (if necessary)
- If necessary, locally or completely remove/replace Thermal Barrier coatings.

Refer to Overhaul Manual Chapter 72-41-01.
Repair using Repair No.14 (Part 2).
Do not mark the Salvage Number for Repair No.14.



U. Machine the Part

- Install the part in a suitable Use a lathermachine and set true.
- 2) Finish turn brazed Outer Barrel H.P.N.G.V. location face to finished dimensions.

Refer to Fig. 401, 403 and 404.

V. Machine the Part (if necessary)

- Install the part in a suitable machine and set true.
- 2) Finish machine brazed Outer Barrel H.P.N.G.V. location face scallop(s) to finished dimensions.

Refer to Fig. 401, 403 and 404.

W. Remove the Burrs

 Remove any burrs using a cutter or aluminium oxide scurf mop. Thinning of parent metal or grinding is not permitted. Use hand held tools. Refer to Fig. 401, 403, 404 and 405.

X. Examine the Part

Do a dimensional inspection of the part.

Use standard inspection equipment. Refer to Fig. 401, 403, 404 and 405.

Y. Penetrant Crack Test

 Do a penetrant crack test on the repair area. Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-002. Use OMat 653 Flourescent penetrant Medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

REPAIR

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Z. <u>Assemble Vaporisers</u>

 Withdraw from stores, Pins, serviceable Vaporisers and Retaining Nuts previously removed and Rivets. Item 1 AS16258 Rivet 16-off. Item 2 AS20669 Pin 32-off. Item 4 B496785 Retaining Nut 16-off. Item 5 B499243 Vaporiser 16-off.

2) Shrink fit the 32-off Pins in position at the 16 Vaporiser locations as shown. Refer to Overhaul Manual Chapter 72-41-01 Repair using Repair No.8. Do not mark the Salvage Number for Repair No.8.

 Assemble the 16-off Vaporisers, Nuts and Rivets. As (2) above.

AA. Examine the Part

 po a visual inspection to ensure satisfactory installation of Vaporisers. Refer to Overhaul Manual Chapter 72-41-01, Repair using Repair No.8.

AB. Install the Shank Nuts

 Withdraw the new Shank Nuts from stores. Item 3 AS27871 Shank Nuts 16-off.

2) Locate the Shank Nuts progressively to rear flange and swage over into the countersunk holes. Refer to Overhaul Manual Chapter 72-09-00 Repair.

AC. Examine the Part

 Do a visual inspection to ensure satisfactory installation of Shank Nuts. Refer to Overhaul Manual Chapter 72-09+00 Repair.

AD. Identify the Repair

 Mark on B517775 or R28 adjacent to the part number. Refer to Overhaul Manual Chapter 72-09-00 Repair. Use vibration peen equipment. Refer to Fig. 401.

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6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER TOOL DESCRIPTION

QTY

NONE

8. REPLACEMENT PARTS

| PART NUMBER | <u>DESCRIPTION</u> | QUANTITY | <u>ITEM</u> |
|-------------|--------------------|----------|-------------|
| AS16258 | Rivet | 16 | 1 |
| AS20669 | Pin | 32 | 2 |
| AS27871 | Shank Nuts | 16 | 3 |
| B495785 | Retaining Nut | 16 | 4 |
| B499243 | Vaporiser | 16 | 5 |

9. STANDARD EQUIPMENT

Degreasing equipment
Hand held tools
Lathe
Penetrant crack test equipment
Standard inspection equipment
Vacuum/Argon atmosphere furnace
Vibration peen equipment

10. CONSUMABLE MATERIAL

| OMat | 3/122 | Stopping-off paint. |
|------|-------|--|
| OMat | 653 | Flourescent penetrant Medium sensitivity |

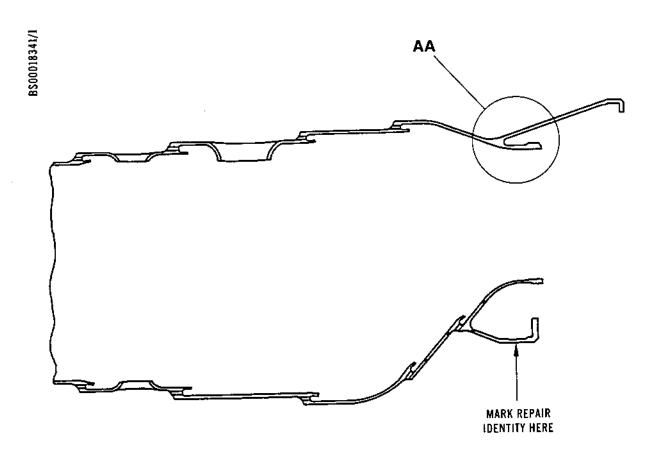
NOTE: 1. To identify the consumable materials refer to the Overhaul Materials Manual (OMat).

 Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

11. EXPENDABLE PARTS

NONE.

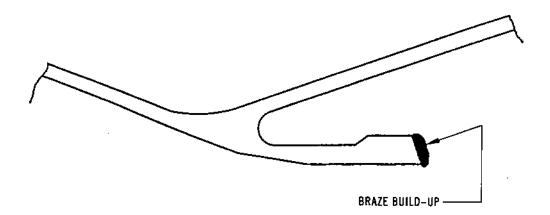
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TYPICAL SECTION THROUGH CHAMBER FIG.401

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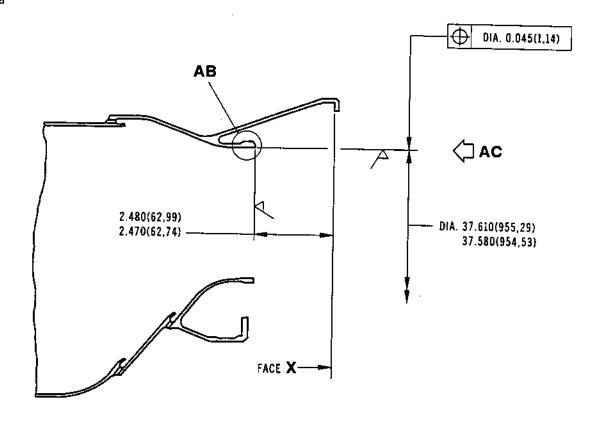
REPAIR



DETAIL AA

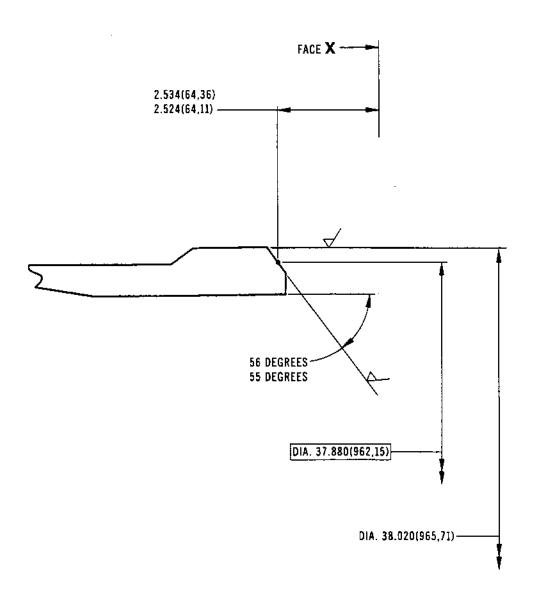
FIG.402

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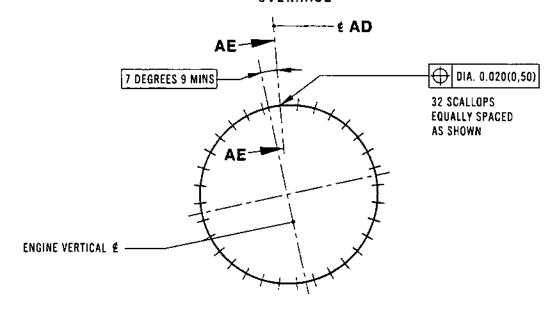
POST BRAZE MACHINING DETAILS FIG.403

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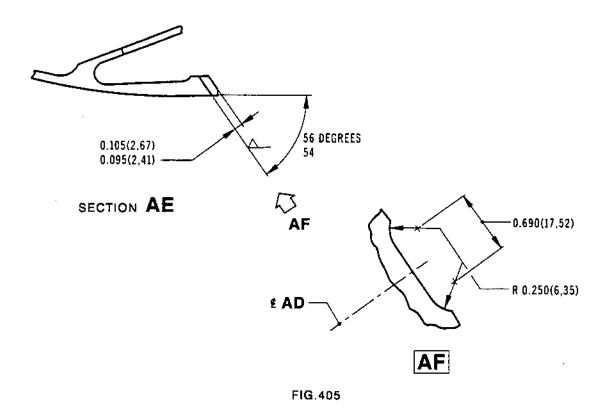


DETAIL AB

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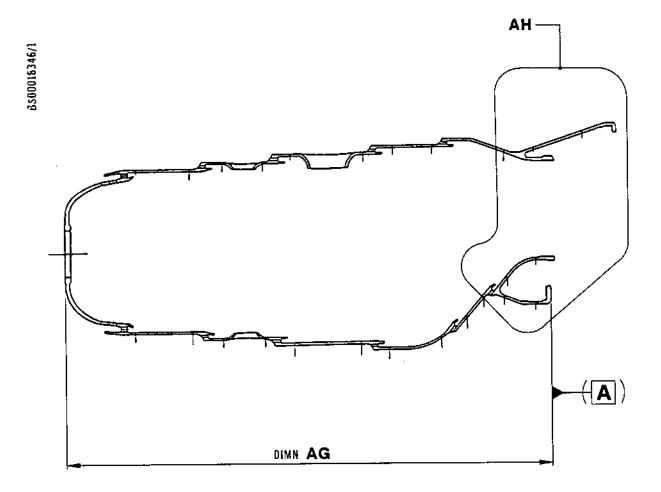


DIAGRAMMATIC VIEW ON AC



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| ASSEMBLY NUMBER | DIMN. AG |
|-----------------|----------------|
| B938173 B512865 | 20.620(523,75) |
| B513927 B514702 | 20.520(521,21) |
| B514706 B516665 | |
| B517450 | |
| B516671 B517452 | 20.645(524,38) |
| | 20.545(521,84) |

FIG.406

8500018347/1



(2.480(62,99)) (2.470(62,74)) (2.710(68,83)) (2.650(67,31))

DETAIL AH

FIG.407

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CHAMBER ASSEMBLY, COMBUSTION (POST MOD.72.9068) COMPLETE REPLACEMENT OF THERMAL BARRIER COATINGS

REPAIR NO. B518353

1. EFFECTIVITY

| I.P.C. | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|-----------------|
| 72-41-01 | 2 10X | B518174 |
| | | B518175 |
| | 2 10W | B518172 |
| | | B518176 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this Repair Process shall be achieved without deviation. Where a need to deviate is considered necessary, reference shall be made to the Repair Authority for agreement.

This instruction gives the procedure for complete replacement of thermal barrier coatings on the chamber assembly, combustion for post-mod.72-9068 standard part numbers, and is designed to be used in conjunction with existing RI's that split and rebuild the combustion chamber.

There is no limitation to the number of times this repair may be carried out provided that specified dimensions are maintained.

Validation testing is not required for this Repair Instruction.

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 (0,1) to 0.020 (0,5)
Machine where marked
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. Mask the Part
- Mask areas where abrasive blast is not required.

Refer to TASK 70-00-00-300-704 SUBTASK 70-00-00-340-704-061.

- B. Clean the Part
- Abrasive blast the part to remove the existing coating.

Refer to Overhaul Manual Chapter 72-09-24 Repair. Use OMat 184 Abrasive medium. Use abrasive blasting equipment.

NOTE: It is accepted that complete removal of the existing bond coat is not practical. However as much coating as possible to be removed to achieve a constant grey matt finish.



C. Examine the Part

 Do a visual inspection of the part for complete removal of the top coat and ensure a constant matt grey appearance has been achieved.

NOTE: If evidence of oxidised bond coating is present (this will appear as a dark discolouration) carry out Para.4.B.(1) until a constant matt grey appearance is achieved.

D. Spray the Part

1) Apply the Bond Coat over distances marked AL. Coating thickness to be 0.003/0.005 (0,08/0,13).

Refer to TASK 70-00-00-300-704 SUBTASK 70-00-00-340-704-001. Use OMat 345 Metal spray powder. Use metal spray equipment. Refer to Figs.401, 402 and 403.

NOTE: Ensure that all cooling holes, drilled and plunged holes and areas around holes shown at views AF and AG are free from coating. Supply compressed air backing to prevent blockage of effusion holes. Coating may be below minimum thickness around plunged holes. Cooling rings to have coating lip edge as shown at detail AK.

E. Crack Test

 Inspect for cracks where coating has been removed. Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-002. Cracks are not permitted.

F. Mask the Part

 Mask the areas which are not to be coated using suitable masking tape or blanking plates. Refer to TASK 70-00-00-300-704 SUBTASK 70-00-00-340-704-061.



G. Spray the Part

1) Apply the top coat over surfaces marked AM and AY. Coating thickness over distances AM to be 0.010/0.012 (0,25/0,30). Coating thickness over distances AY to be 0.018/0.022 (0,46/0,56).

Refer to TASK 70-00-00-300-704 SUBTASK 70-00-00-340-704-001. Use OMat 3/185 Metal spray powder. Use metal spray equipment. Refer to Figs.401, 402 and 403.

NOTE: Ensure that all cooling holes, drilled and plunged holes and areas around holes shown at views AF and AG are free from coating. Supply compressed air backing to prevent blockage of effusion holes. Coating may be below minimum thickness around plunged holes. Cooling rings to have coating lip edge as shown at detail at detail AK.

H. Examine the Part

 Do a visual inspection of the coating for evidence of blistering, lifting, cracking or chipping. Refer to TASK 70-00-00-300-704 SUBTASK 70-00-00-340-704-001.

J. Restore Sermaloy J Coating

 Restore Sermaloy J coating overlap at the No.2 inner and outer cooling ring positions and to any damaged areas on the front fairing. Refer to Overhaul Manual Chapter 72-41-01. Repair using Repair No.19. Do not mark the salvage number for Repair No.19. Refer to Fig.401.

K. Identify the Repair

 Vibration peen B518353 or R29, and repeat repair suffix if applicable, adjacent to the part number. Refer to TASK 70-00-00-300-363 SUBTASK 70-00-00-180-363-027. Use vibration peen equipment. For repeat repairs to this instruction (on the same part), add a suffix /2, /3 etc as applicable (to indicate second occasion, third occasion etc.).

REPAIR

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Repair No.29
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5. MATERIAL

COMPONENT

MATERIAL

RR CODE

CHAMBER ASSEMBLY, COMBUSTION

MSRR 7038 (C263) QAU

6. DATA

NONE.

7. <u>TOOLS</u>

NONE.

8. REPLACEMENT PARTS

NONE.

9. STANDARD EQUIPMENT

Abrasive blasting equipment Metal spray equipment Vibration peen equipment

10. CONSUMABLE MATERIAL

OMat 184 OMat 3/185 OMat 345

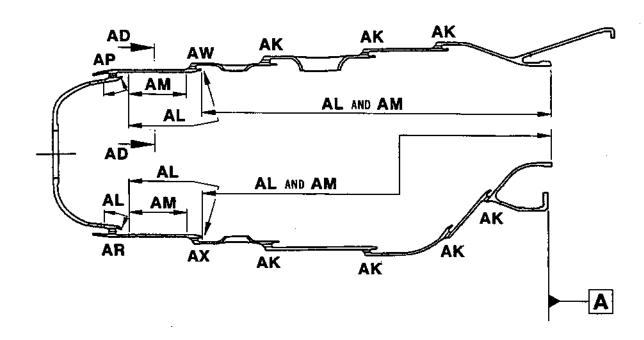
NOTE: 1. To identify the consumable materials refer to the Overhaul Materials Manual (OMat).

 Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

11. EXPENDABLE PARTS

NONE -

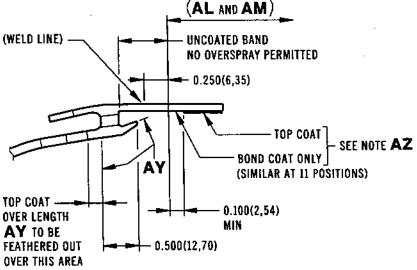
BS00028159/1



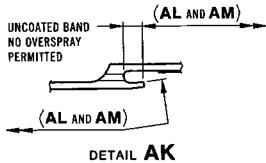
Section Through Combustion Chamber Figure 401

REPAIR
72-41-01
Repair No.29
Page 406
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DETAIL AP
DETAIL AR SIMILAR



UNCOATED BAND
NO OVERSPRAY
PERMITTED

AY

0.500(12,70)

0.250(6,35) TOP COAT OVER LENGTH
TO BE FEATHERED OUT OVER THIS AREA
TO THICKNESS AT SURFACE AM

DETAIL AW
DETAIL AX SIMILAR

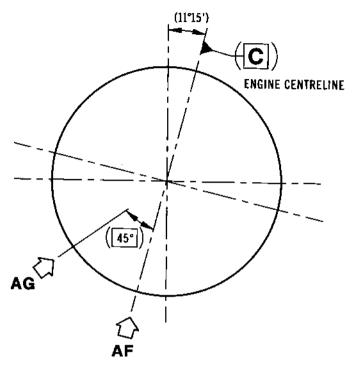
NOTE AZ: COATINGS TO BE FEATHERED TO AVOID HARD EDGE.
TOP COATINGS ARE NOT TO EXTEND BEYOND BOND COAT
SEE DETAIL AP

Combustion Chamber - Details Figure 402

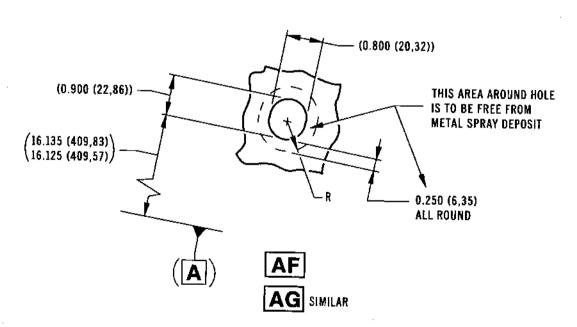
REPAIR

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SECTION AD



Combustion Chamber - Details Figure 403

REPAIR

/2-41-01 Repair No.29

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COMBUSTION CHAMBER OUTER CASE - REPAIR

TABLE OF CONTENTS

| Repair No. | Title | Scheme No. |
|------------|--|-----------------------|
| 1 | Flanged Sealing Bar - Restoration of Fretted Sealing Diameter by Welding. | B ₋ 513694 |
| 2 | Combustion Chamber Outer Case - Restoration of Fretted Ends of Vane Locking and Extended Head Pins. | B.513668 |
| ·3 | Flanged Sealing Bar - Restoration of Fretted Sealing Diameter by Welding. | в.513856 |
| 4 | Tube, Support, Assy of. Repair Fractured Lug by Replacement. | B.513629 |
| 5 | Tube, A/O Support Repair of Defective Tube by Replacement of Section. | B.513630 |
| 6 | Case, Assembly of, Outer Combustion Chamber. Repair of stripped thread at HPT NGV locking pin positions by fitting a solid insert. | B.515321 |
| 7 | Case, Assembly of, Outer Combustion Chamber. Provision for the blending of damage on the bolt locating diameter. | B.516404 |

BAR SEALING FLANGED - REPAIR RESTORATION OF FRETTED SEALING DIAMETER BY WELDING

REPAIR NO. B513694

1. Effectivity

 I.P.C.
 Fig./Item
 Part No.

 72-42-01
 2
 220A
 B427632

Introduction

A. General.

- (1) This repair describes the procedure for restoring the fretted sealing diameter of the flanged sealing bar, Part Number B427632, by welding and machining.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Tolerances on machined angles are plus/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of this repair process should be achieved without deviation. Where deviation is considered necessary agreement should first be sought from the Repair Authority.
- (2) The material specification of Bar, Sealing Flanged is Nickel Alloy to MSRR 7013 (Rolls-Royce code QAK).

Instructions

- A. Preparation.
 - (1) Refer to Figure 401. Mount the component in a grinding machine and set true to datum.

REPAIR

72-42-01

B. Machine.

(1) Refer to Figure 401. Machine the sealing diameter to remove fretting.

NOTE: Remove only minimum material. Do not encroach into 0.100 in. (2,54 mm) radius of flange. Minimum diameter after machining 0.480 in. (12,19 mm).

C. Inspect.

(1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.

D. Weld.

- (1) Referring to TSD 594-409, prepare component for welding.
- (2) Using filler rods to MSRR 9500/4, weld with inert gas arc building up the machined area a sufficient depth to allow a final machined diameter of 0.498 to 0.497 in. (12,65 to 12,62 mm) to be achieved.

E. Inspect.

(1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.

F. Heat Treat.

(1) Heat treat the component at 800°C plus/minus 10°C using Argon/Hydrogen for two hours. Rapid gas quench.

G. Inspect.

(1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.

H. Machine.

- (1) Referring to Figure 401, mount the component in a grinding machine and set true to datum.
- (2) Grind the component to produce a sealing diameter of 0.498 to 0.497 in. (12,65 to 12,62 mm).
- (3) Clean up angle face and chamfer as necessary.

REPAIR

72-42-01



J. Inspect.

- (1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.
- (2) Refer to Figure 401. Check the dimension of the sealing diameter.

K. Identify.

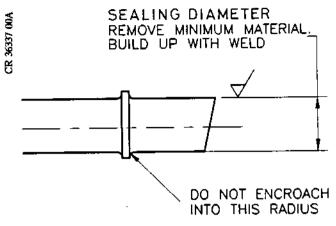
- (1) Mark the component SAL B513694 close to the existing part number using vibro-percussion engraving marking as specified in Chapter 72-09-00, Repair.
- Special Tools, Fixtures and Equipment

None.

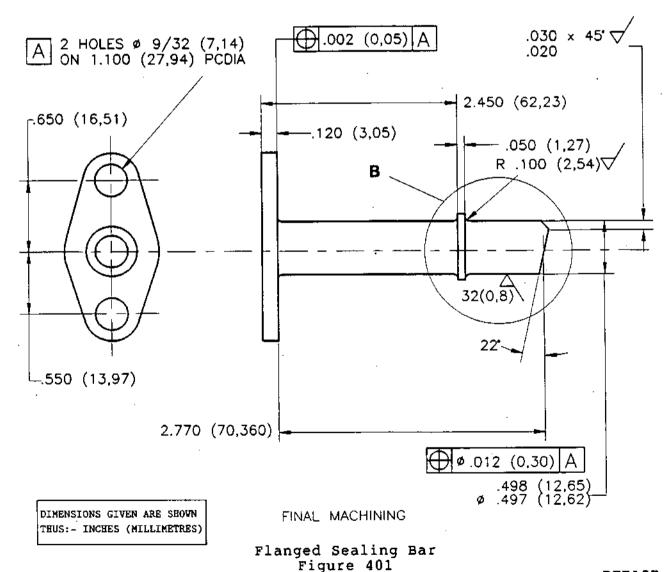
Replacement Parts

None.





PART VIEW AT **B** SHOWING PRE WELD MACHINING



REPAIR

72-42-01

Repair No. 1 Page 404 Jun 1/91

COMBUSTION CHAMBER OUTER CASING - REPAIR RESTORATION OF FRETTED ENDS OF VANE LOCKING AND EXTENDED HEAD PINS

REPAIR NO. B513668

1. Effectivity

| I.P.C. | Fig./I | tem | <u>Part No.</u> | |
|----------|--------|-----|-----------------|--|
| 72-42-01 | 6 | 20A | B446079 | |
| | 6 | 20A | B473793 | |

2. Introduction

A. General.

- (1) This repair describes the procedure for the restoration of fretted square ends of combustion chamber outer casing Vane Locking Pins and Extended Head Pins by weld repair.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Tolerances on machined angles are plus/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of these repairs should be achieved without deviation. Where a need to deviate is considered necessary, agreement should first be sought from the Repair Authority.
- (2) The pin material specification is NIMONIC 80A MSRR 7011, Rolls-Royce code QAL.

REPAIR

72-42-01

3. Instructions

- A. Preparation.
 - (1) Refer to Figure 401. Examine square ends of pins to identify fretted areas.
 - (2) Using hand tools only, and removing only the minimum amount of material, vee-groove the defective areas to produce a smooth profile.

B. Inspect.

(1) Carry out crack detection as specified for this component in Chapter 72-09-00, Inspection/Check.

C. Weld.

- (1) Refer to TSD 594-409 and prepare component for welding.
- (2) Weld the blended area using filler rods to MSRR 9500/4.

D. Inspect.

(1) Carry out crack detection as specified for this component in Chapter 72-09-00, Inspection/Check.

E. Heat Treat.

(1) Heat treat at 700°C plus/minus 5°C for 16 hours (W1P).

F. Machine.

- (1) Refer to Figure 401. Mount the component in a milling machine and set true to datum A.
- (2) Machine the square end to its original profile, ensuring that the parent material is not impaired.

G. Inspect.

- (1) Carry out crack detection as specified for this component in Chapter 72-09-00, Inspection/Check.
- (2) Refer to Figure 401. Check the dimensions of the machined square end.

REPAIR

72-42-01



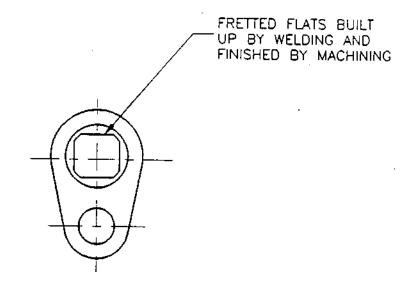
- H. Vapour Blast.
 - (1) Vapour blast the component all over. Refer to Chapter 72-09-13, Repair. Use procedure A.
- J. Identify.
 - (1) Mark the component SAL B513668 adjacent to the existing part number using vibro-percussion engraving marking as specified in Chapter 72-09-00, Repair.
- 4. Special Tools, Fixtures and Equipment

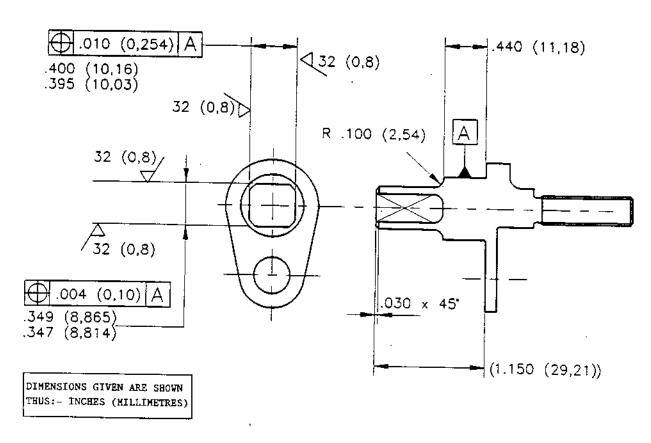
None.

5. Replacement Parts

None.







Vane Locking and Extended Head Pins Figure 401

REPAIR

72-42-01

Repair No. 2 Page 404 Jun 1/91



BAR SEALING FLANGED - REPAIR RESTORATION OF FRETTED SEALING DIAMETER BY WELDING

REPAIR NO. B513856

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u> 72-42-01 2 140A B400648

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the fretted sealing diameter of the Flanged Sealing Bar, part number B400648, by welding and machining.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Tolerances on machined angles are plus/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of this repair process should be achieved without deviation. Where deviation is considered necessary agreement should first be sought from the Repair Authority.
- (2) The material specification of B400648 Bar Sealing Flanged is Waspaloy to MSRR 7034 (Rolls-Royce code QDY).

REPAIR

72-42-01

3. Instructions

- A. Preparation.
 - (1) Refer to Figure 401. Mount the component in a grinding machine and set true to datum.
- B. Machine.
 - (1) Refer to Figure 401. Machine the sealing diameter to remove fretting. The minimum permissible machined diameter is 0.425 in. (10,795 mm).

NOTE: Remove only minimum material. Do not encroach into 0.050 in. (1,27 mm) radius of flange.

- C. Inspect.
 - (1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.
- D. Weld.
 - (1) Referring to TSD 594-409, prepare component for welding.
 - (2) Using filler rods to MSRR 9500/202, weld with inert gas arc building up the machined area a sufficient depth to allow a final machined diameter of 0.445 to 0.440 in. (11,303 to 11,176 mm) to be achieved.
- E. Inspect.
 - (1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.
- F. Heat Treat.
 - (1) Heat treat the component at 850°C plus/minus 10°C using inert/vacuum process for four hours. Rapid gas quench.
- G. Inspect.
 - (1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.

REPAIR

72-42-01



H. Machine.

- (1) Referring to Figure 401, mount the component in a grinding machine and set true to datum.
- (2) Grind the component to produce a sealing diameter of 0.445 to 0.440 in. (11,303 to 11,176 mm).
- (3) Clean up angle face as necessary.
- J. Inspect.
 - (1) Carry out crack detection as specified for this component in Chapter 72-42-01, Inspection/Check.
 - (2) Refer to Figure 401. Check the dimension of the machined sealing diameter.
- K. Identify.
 - (1) Mark the component SAL B513856 close to the existing part number using vibro-percussion engraving marking as specified in Chapter 72-09-00, Repair.
- Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.

72-42-01

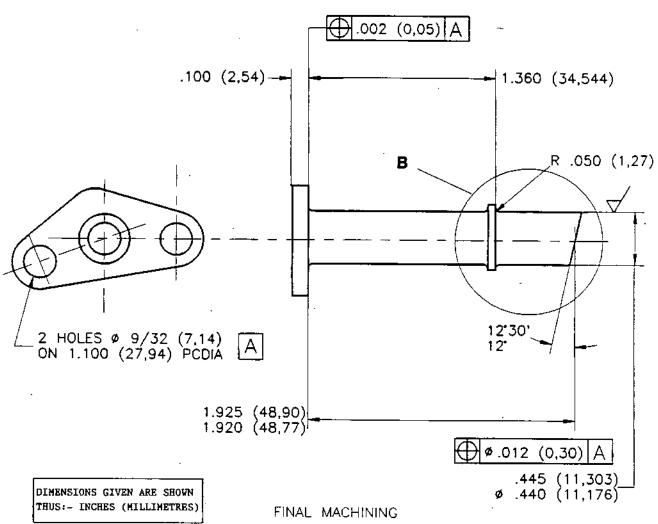
Jun 1/91



SEALING DIAMETER
REMOVE MINIMUM MATERIAL
BUILD UP WITH WELD

DO NOT ENCROACH
INTO THIS RADIUS

PART VIEW AT **B** SHOWING PRE WELD MACHINING



Flanged Sealing Bar Figure 401

REPAIR

72-42-01

Repair No. 3 Page 404 Jun 1/91



TUBE, SUPPORT, ASSY OF.

REPAIR FRACTURED LUG BY REPLACEMENT

REPAIR NO. B513629

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-42-01

230A

B458730

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process must be achieved without deviation. Where a need to deviate is considered necessary reference must be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED

Drawing practice & tolerance interpretation to ISO1101 (JES160) dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

1) Using hand tools only, partoff defective tube 11.500" from tube end.

2) Set true on a centre lathe and machine to remove defective lug.

SUPPLEMENTARY INFORMATION

Refer fig. 401 Care is to be taken that the tube 0/D is not impaired.

NOTE: Thinning of material is not acceptable. Care is to be taken that the tube 0/D is not impaired.

72-42-01 Repair No. 4 Page 401 Dec 1/91



3) Remove any burrs/sharp edges.

4) Dimensionally inspect.

Refer fig. 401

5) Crack detect.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check.

6) Select replacement lug and loosely

Refer Para 8. Replacement Parts item 1.

Refer fig. 402

7) Select special tube joint B439593 and trial fit the two pieces of the tube assemblies.

Refer Para 8. Replacement

Parts item 2. Refer fig.402

8) Using hand tools size the length of tube assembly B458731ND if applicable, so that overall length is achievable.

Refer fig.402

9) Assemble and orbital weld 2 pieces of pipe assemblies to tube joint. Refer to TSD 594 OP 409. Refer Para 8. Replacement Parts item 2.

10) Crack detect.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check

 Align new lug and braze in position. Refer to TSD 594-416 using Nicrobraz 130 or LM. Refer fig.401 and 402

12) Dimensionally inspect.

Refer fig. 402

13) Mark on SAL B513629 or R4 adjacent to existing part number using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

TUBE SUPPORT, ASSEMBLY OF

MSRR 6524 Stainless Steel EBS

72-42-01 Repair No. 4 Page 402 Dec 1/91 6. <u>DATA</u>

7. <u>TOOLS</u>

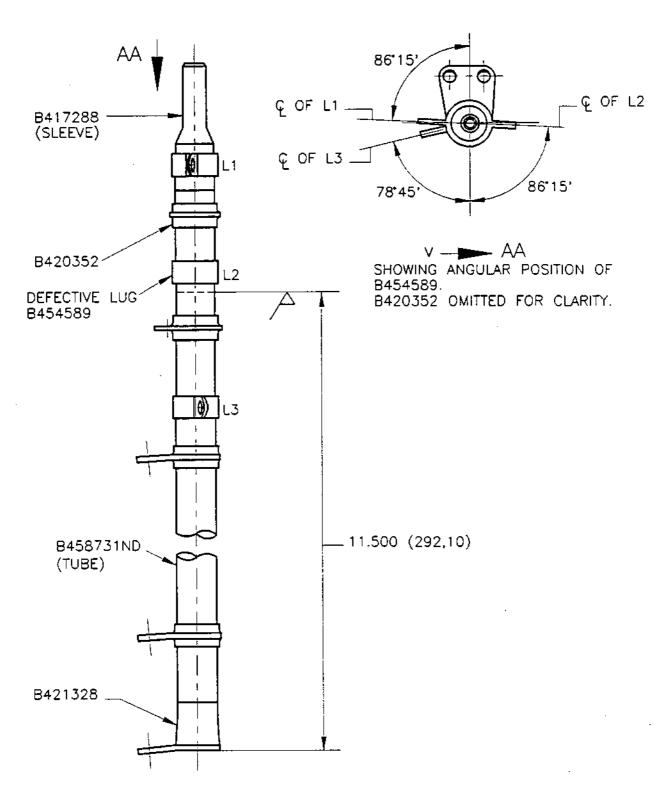
NONE

NONE

8. REPLACEMENT PARTS

| PART NUMBER | DESCRIPTION | QUANTITY | ITEM |
|-------------|-------------|----------|------|
| 8454589 | LUG. | 1-0FF | 1 |
| B439593 | TUBE JOINT. | 1-0FF | 2 |

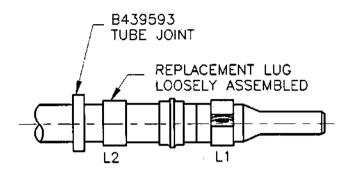




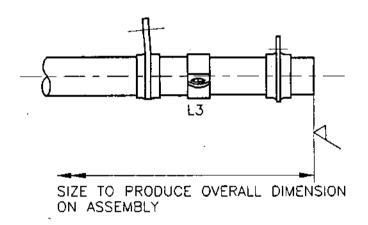
B458730 - TUBE, SUPPORT, ASSY. OF FIG.401

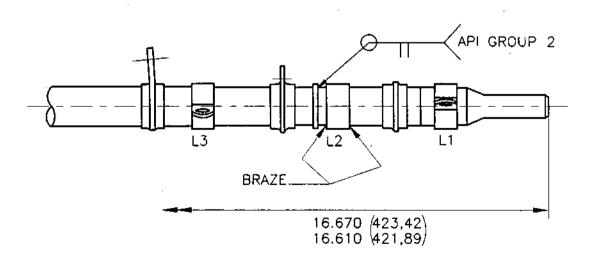
72-42-01 Repair No.4 Page 404 Dec 1/91





VIEW SHOWING TRIAL FIT OF TUBE JOINT





VIEW SHOWING FINAL ASSEMBLY FIG.402

72-42-01 Repair No.4 Page 405 Dec 1/91



TUBE, A/O SUPPORT REPAIR OF DEFECTIVE TUBE BY REPLACEMENT OF SECTION

REPAIR NO. B513630

1. EFFECTIVITY

IPC Fig./Item

Part No.

72-42-01

01 2708

B490065 B490066

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Using hand tools only, carefully part off defective section of tube 2.000(50,80) from rear most bracket B417343 (item 2).

Refer fig.402

 Dress end of retained part.
 NB. Thinning of material is not acceptable. Refer fig.404

3) Crack detect repair area.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check.

72-42-01 Repair No. 5 Page 401 Dec 1/91



4) Obtain a replacement length of stainless steel tube and form to dimensions shown.

Refer fig.402
Tube details:
0/D 0.875(22,23).
Wall section 0.036/0.040
(0,91/1,02).
Material MSRR6524 EEC.

5) Crack detect formed tube all over.

Refer Overhaul Manual Chapter 72-09-00 Inspection/Check

6) Obtain special tube joint and trial fit existing assembly to new tube section. Refer Para 8. REPLACEMENT PARTS Item 3

7) Dress end of new tube section using hand tools only, to achieve overall length.

Refer fig.401, 403 and 404

8) Assemble and auto-weld new tube section and existing assembly to tube joint. Refer TSD 594 OP.409 Group 1 weld. Refer fig.403

Visually inspect quality of weld.

Refer TSD 594 OP 409

10) Crack detect repair area.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check

11) Radiologically inspect weld joints.

Refer TSD 594 OP 409

12) Obtain new bracket and fit to new tube section by aligning with existing bracket B417343. Braze bracket into position. Refer TSD 594 OP 416 Braze filler Nicrobraze 130 (MSRR 9500/114). Refer Para 8. REPLACEMENT PARTS Item 2 Refer fig.401 and 403

13) Visually inspect brazing.

TSD 594 OP 416 Refer fig.403

14) Crack detect brazed areas.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check

15) Dimensionally inspect.

Refer fig.401

72-42-01 Repair No. 5 Page 402 Dec 1/91



| 16) Obtain new tube end B417288 an | nd Refer | TSD 594 |
|------------------------------------|----------|---------|
| fit to new tube section. | Group | 1 weld. |
| Auto-weld into position. | Refer | Para 8. |
| · | PARTS | Item 1 |
| | Refer | fig.401 |
| | | |

17) Visually inspect quality of weld.

Refer TSD 594 OP 409

594 OP 409

.401 and 403

a 8. REPLACEMENT

18) Crack detect repaired areas.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check

19) Radiologically inspect weld joints.

Refer TSD 594 OP 409

20) Dimensionally inspect.

Refer fig.401

21) Mark \$AL B513630 or R5 adjacent to existing part number using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

TUBE, A/O SUPPORT

STAINLESS STEEL MSRR 6524 EEC

6. DATA

NONE

7. <u>TOOLS</u>

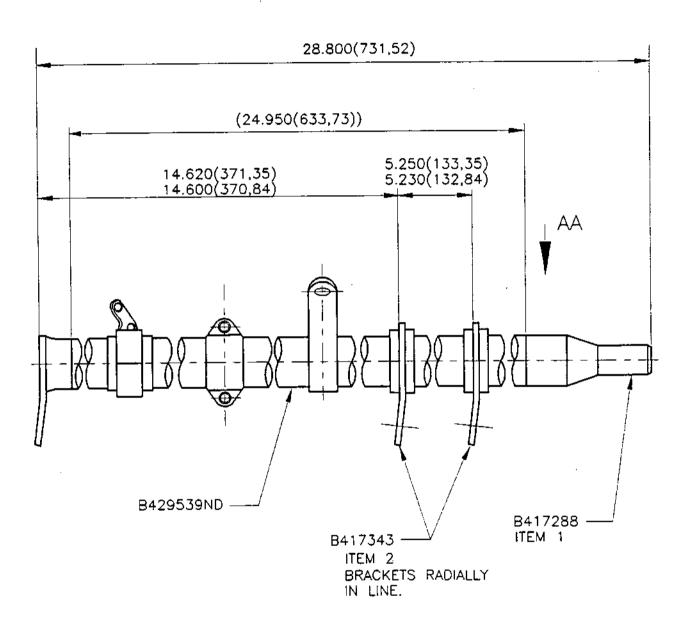
NONE

8. REPLACEMENT PARTS

| PART NO. | DESCRIPTION | QUANTITY | ITEM |
|------------|-------------|----------|------|
| B417288 | TUBE END | 1 | 1 |
| B417343 | BRACKET | 1 | 2 |
| B445307L10 | PIPE JOINT | . 1 | 3 |

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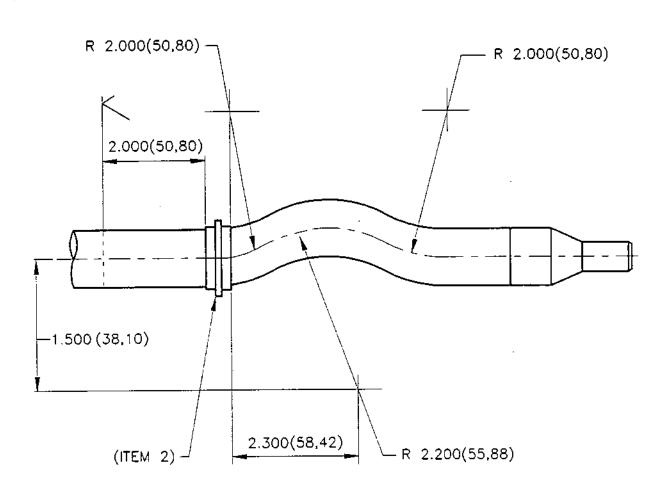




TOLERANCES \pm 0.030(0,76) U.O.S.

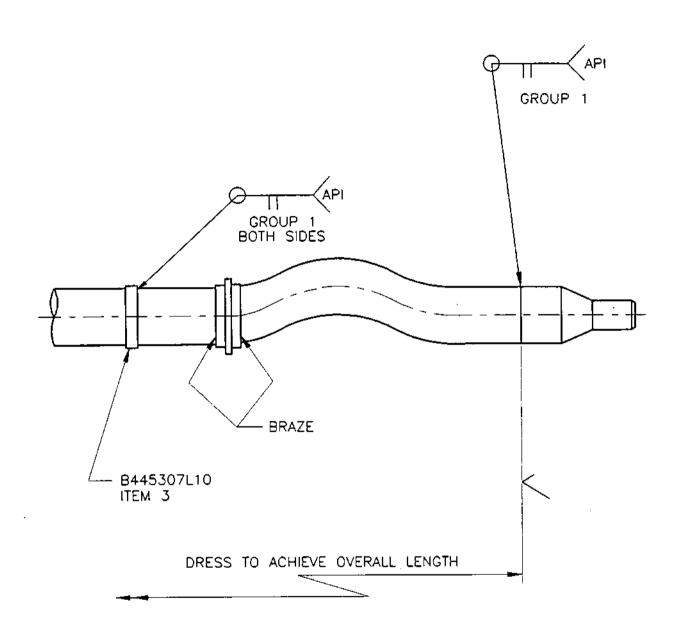
GENERAL VIEW OF TUBE, A/O SUPPORT FIG.401

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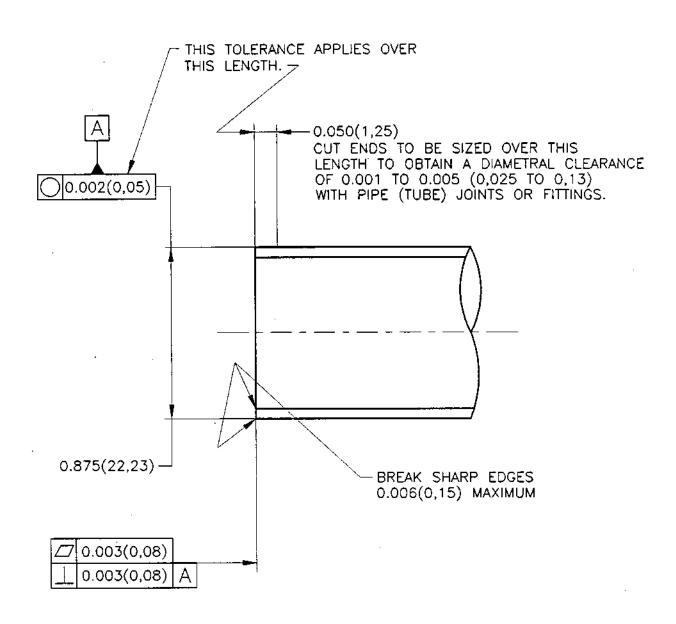
VIEW AT AA FIG.402





REPEAT VIEW AT AA FIG.403

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TYPICAL TUBE END PREPARATION FIG.404

72-42-01 Repair No. 5 Page 407 Dec 1/91



CASE, ASSEMBLY OF, OUTER COMBUSTION CHAMBER

PIN POSITIONS BY FITTING A SOLID INSERT.

REPAIR NO. B515321

1. EFFECTIVITY

| IPC | Fig./Item | <u>Part No.</u> |
|----------|-----------|-----------------|
| 72-42-01 | 2/410A | B919218 |
| | 410B | B919216 |
| | 410c | B925806 |
| | | B927190 |
| | | B919244 |
| | 410b | B919240 |
| | 410E | B928171 |
| | | B927196 |
| | | B928173 |
| | | B928175 |
| | | B928176 |
| | 410F | B928174 |
| | 410G | B919206 |
| | 410H | B919239 |
| | 410J | B928172 |
| | | B928178 |
| | | B919671 |
| | | В919672 |
| | | B919673 |
| | | B919674 |
| | | В919204 |
| | | B919207 |
| | | B919208 |
| • | | B933211 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be embodied once only, at any number of locations.

3. **GENERAL**

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)

REPAIR

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Repair No. 6
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Tolerances on machined dimensions plus/minus 0.010 (0,25) Tolerance on angles plus/minus 2 degrees Break sharp edges 0.004 to 0.020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 125(3,2) Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

| 4. | REPAIR PROCEDURE | SUPPLEMENTARY INFORMATION |
|-----|--|---|
| 1) | Locate component to machine and set true to datums A and B. | Refer Fig.401. |
| 2) | Clock existing NGV locking pin hole and face true. | Refer Fig.402. |
| 3) | Machine to remove defective threads and produce oversize tapped hole. | Refer fig.402. |
| 4) | Locally crack detect repair area. | Refer Overhaul Manual Chapter 72-42-01 Inspection/Check. |
| 5) | Fit solid insert to repair location and lock down on run out threads. | Refer Fig.403. Refer Para.8. Replacement Parts, Item 2. |
| 6) | Locate component to machine and set true to datums A and B. | Refer Fig.401. |
| 7) | Clock existing NGV locking pin hole and face true. | Refer Fig.402. |
| 8) | Machine solid insert flush to existing locking pin face. | Refer Fig.403. |
| 9) | Machine chamfer in outer end of solid insert. | Refer Fig.403. |
| 10) | Machine to produce locking pin hole. Hole to be within an area of maximum material. Ensure all swarf is removed. | Refer Fig.403. |
| 11) | Assemble insert locking pin to hole. Drive below face and peen surrounding surface lightly over, all round top of pin. | Refer Fig.403. Refer Para.7. Tools, Item 1 and Para.8. Replacement Parts, Item 3. |

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12) Locally crack detect repaired area.

Refer Overhaul Manual Chapter 72-42-01 Inspection/Check.

13) Mark Repair Instruction number RI B515321 or R6 adjacent to normal 'assy.of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.401 for identity marking location.

5. MATERIAL

<u>COMPONENT</u>

MATERIAL

RR CODE

CASE, ASSEMBLY OF, OUTER COMBUSTION CHAMBER

WASPALOY MSRR 7084 QFG

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

T111844

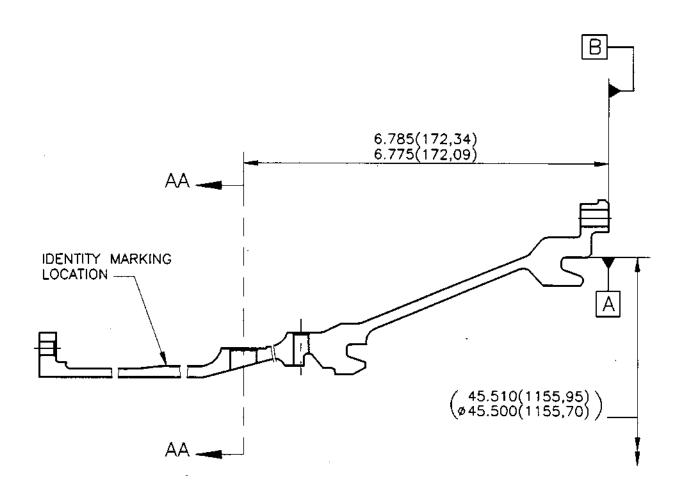
PEENING TOOL

1

8. REPLACEMENT PARTS

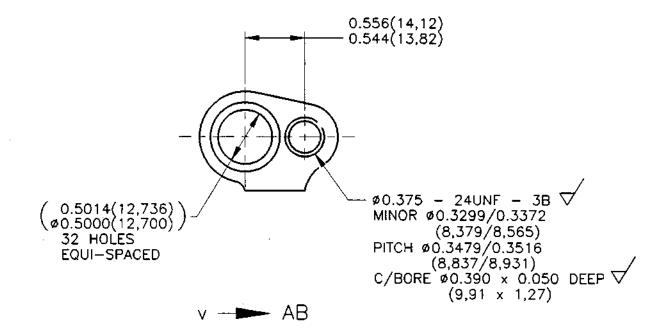
| PART NUMBER | <u>DESCRIPTION</u> | QUANTITY | <u>ITEM</u> |
|-------------|----------------------|-------------|-------------|
| B515401 | INSERT, SCREW THREAD | AS REQUIRED | 2 |
| B515402 | PIN. LOCKING | AS REQUIRED | 3 |

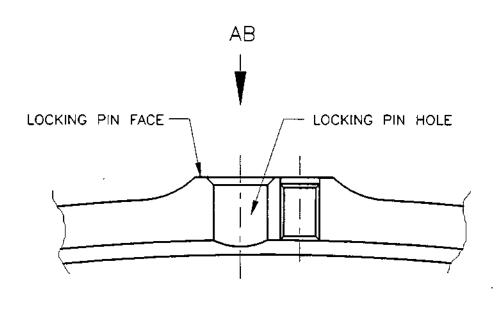




TYPICAL SECTION THROUGH CASING FIG.401

REPAIR
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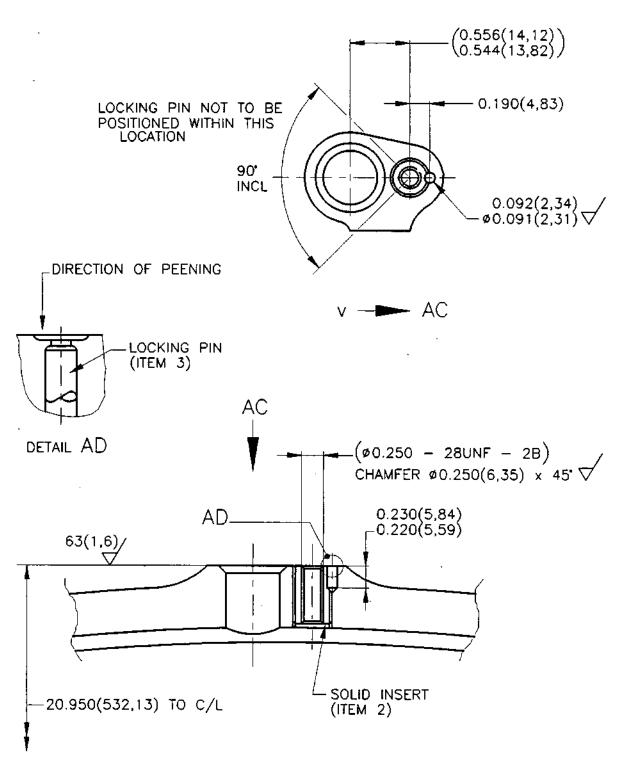




SECTION AA

FIG.402





REPEAT SECTION AA SHOWING FITMENT OF INSERT AND LOCKING PIN FIG. 403

REPAIR 72-42-01 Repair No. 6 Page 406 Jul 31/93



K.610-14-28 snecma OVERHAUL

CASE, ASSEMBLY OF, OUTER COMBUSTION CHAMBER.

PROVISION FOR THE BLENDING OF DAMAGE ON THE BOLT LOCATING DIAMETER.

B516404

1. <u>EFFECTIVITY</u>

| IPC | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|-------------------|----------------------|
| 72-42-01 | 2/410A 2A/410B | B919218 B919216 |
| | 2A/410C | B925806 B927190 |
| | 2A/410D | B919244 B919240 |
| | 2/410E | B928171 B927196 |
| | | B928173 B928175 |
| | 34//405 | B928176 B928174 |
| | 2A/410F 2/410G | B919206 |
| | 2/410H 2/410J | . В919239 В928172 |
| - | | B928178 B919671 |
| | | B919672 B919673 |
| | | B919674 B919204 |
| | | B919207 |
| | | B919208 B933211 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Blending is limited to the removal of high metal and sharp edges from the dee head bolt locating diameter only.

This Repair Instruction may be embodied any number of times provided that the maximum residual depth of damage does not exceed 0.025(0,64) after removal of high metal.

REPAIR

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3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

Using hand tools only, carefully blend to remove high metal and sharp edges only. Remove the minimum amount of material. All blends to be smooth and continuous.

2) Using abrasive mat or fine grade abrasive papers/cloth, lightly polish to restore surface finish.

- Locally swab etch repair area.
- 4) Binocular inspect at X15 magnification.
- 5) Locally dye penetrant inspect repair area.
- 6) locally vapour or alternatively dry abrasive blast repair area.
- 7) Mark Repair Instruction number RI B516404 or R7 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

SUPPLEMENTARY INFORMATION

Refer Fig. 401.
Refer para. 2 Repair limits.
Refer Overhaul Manual
Chapter 72-09-22 Repair.

Refer Fig. 401. Use OMat 583 or 5/44.

Refer Overhaul Manual Chapter 72-09-14 Repair, using Solution C.

Refer TSD 594 OP.210.

Refer TSD 594 OP.338. 2N minimum intensity and 200% coverage. Use OMat 1/244 (vapour blast) or OMat 146 (dry blast)

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.401.

REPAIR

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OVERHAUL

5. MATERIAL

> MATERIAL RR CODE COMPONENT

CASE, ASSEMBLY OF, OUTER WASPALOY

MSRR 7084 COMBUSTION CHAMBER.

6. DATA

NONE.

7. TOOLS

> ITEM TOOL NUMBER DESCRIPTION

NONE.

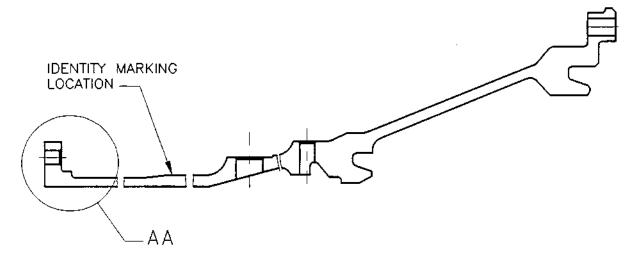
REPLACEMENT PARTS 8.

> **ITEM** QUANTITY **DESCRIPTION** PART NUMBER

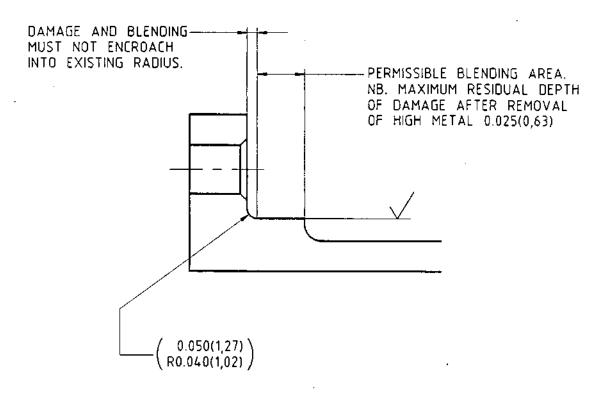
NONE.

QFG





TYPICAL SECTION THROUGH CASING



DETAIL AA

SHOWING TYPICAL VIEW OF BOLT LOCATING DIAMETER. FIG.401

REPAIR

A O O 1

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HP TURBINE BEARING SUPPORT - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|-----------|------------|--|------------------|
| pue | 1 | Labyrinth Cover Seal Land Repaired by Application of Abradable Coating | SAL.B.470398 |
| n England | 2 | Bearing Housing Seal Lands Repaired by Application of Abradable Coating | SAL.B.470399-400 |
| ed in | 3 | Labyrinth Ring Seal Land Repaired by Application of Abradable Coating | SAL.B.478070 |
| Printed | 4 | Labyrinth Shroud Seal Lands Repaired by Application of Abradable Coating | SAL.B.478075-6 |
| | 5 | CANCELLED (See Table of Approved Schemes) | |
| | 6 | Outer Air Duct Repaired by Restoring the Bore Diameter | SAL.B.492081 |
| | 7 | Labyrinth Cover - Replacement of Worn No.4 Bearing Cooling Air Tube Housings | SAL.B.497478 |
| | 8 | <pre>HP Turbine Bearing Support - Tube Elbow Bores Restored by Renewing Existing Anti-Fret Coating</pre> | SAL.B.506296 |
| | 9 | <pre>HP Turbine Bearing Support - Insulated Tube Assembly Repaired by Replacing Anti-Fret Coating</pre> | SAL.B.507160 |
| | 10 | HP Turbine Bearing Support - Insulated Tube Assembly Repaired by Replacing Spherical Ends | SAL.B.507159 |
| | 11 | Duct A/O Air Provision for Restoration of Fretted Internal Diameters of Seal Carriers | SAL.B.513510 |
| | 12 | Bearing Housing - Removal of distortion from rear flange by machining | SAL.B.515001 |
| | 13 | Blanket, Assy of, Insulation Front and Rear Covers. Repair of damaged blankets by patching and weld repair | SAL.8.517833-4 |
| | | of bracket(s) | REPAIR 72-51-01 |
| | | | /ソ トコ_(17 |

72-51-01

Contents 1

Jun 1/98

HP TURBINE BEARING SUPPORT - REPAIR LABYRINTH COVER SEAL LAND REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Labyrinth Cover B.445897

Authority:

Modification No. OL. 7507C

1. Introduction

- A. This Repair describes the procedure for restoring the labyrinth cover seal land, in order to maintain the standard fin/cover clearances of labyrinth No.13. The defective location is first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus on illustrations: INCHES (MILLIMETRES).

Repair Limitations

- A. There is no restriction on the number of times this repair may be applied provided that specified dimensions are maintained.
- B. Verify that there is adequate material at the defective location to permit machining to the dimensions before spraying (Ref.para.3.B.).

3. Summary of Operations

- A. Set the labyrinth cover true on datum diameter A and face B (Ref.Fig. 401).
- B. Machine the seal land to the specified dimensions (Ref.Fig.402).
- C. Crack test the cover with fluorescent-penetrant.

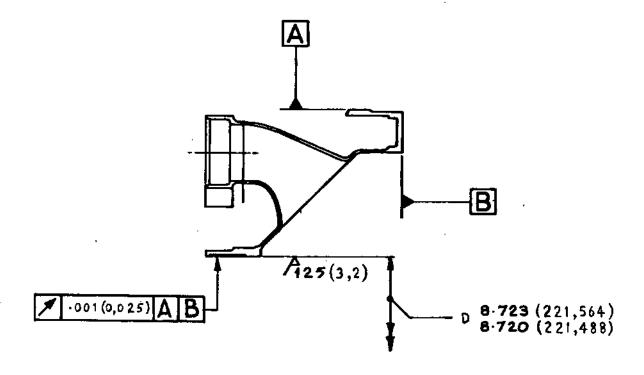
REPAIR

IK.610-14-28 snecma OVERHAUL

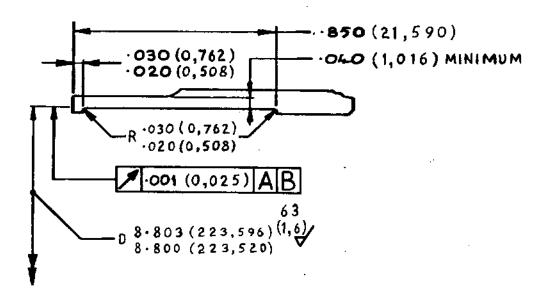
- D. Apply abradable coating (Ref.Fig.403).
 - (1) Combustion flame spray the prepared seal land with a bond coating of Metco 450NS, 0.003 in./0.005 in. (0,076 mm/0,127 mm) in thickness.
 - (2) Flame spray Sherritt Gordon 75/25 Nickel/Graphite abradable coating or Metco 313NS 0.045 in. (1,14 mm) in thickness over the bond coating.
- E. Finish machine the seal land (Ref.Fig.401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Mark the coating identification symbols, Sherritt-Gordon

 (HA) and (NG) or Metco (HA) and (GA) as applicable, using
 the electro-chemical or vibro-percussion marking technique
 detailed in 72-09-00 Repair.
- H. Identify repair. Mark the repair scheme number SAL B.470398 close to the standard part number on the labyrinth cover.



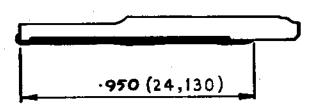


Standard Dimensions Figure 401



Machining Dimensions Before Spraying Figure 402

REPAIR 72-51-01 Repair No.1 Page 403 Aug 1/75



OVERSPRAY PERMITTED ON END FACE AND ON SEAL BORE WITHIN DIMENSION SHOWN. THIS IS TO BE REMOVED:

Spraying Detail Figure 403

TN2651

HP TURBINE BEARING SUPPORT - REPAIR BEARING HOUSING SEAL LANDS REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Housings B.919777, B.919779, B.451076, B.445790

Authority:

Modification No. OL.7507C

1. Introduction

- A. This Repair describes the procedure for restoring seal lands on the hp turbine bearing housing, in order to maintain the standard fin/housing clearances of labyrinth No.14 and No.15. The defective locations are first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus on illustrations: INCHES (MILLIMETRES).

Repair Limitations

- A. One seal location, or both, may be restored at one repair.
- B. Verify that there is adequate material at each defective location to permit machining to the dimensions before spraying (Ref.para.3.B.).

3. Summary of Operations

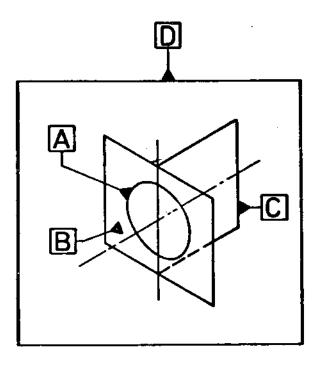
- A. Set the bearing housing true on datum bore A and flange face B (Ref.Fig. 401 and 402).
- B. Machine defective locations to the specified dimensions (Ref.Fig. 403).
- C. Crack test the bearing housing with fluorescent-penetrant.
- D. Apply abradable coating (Ref.Fig.404).

- (1) Combustion flame spray the prepared seal lands with a bond coating of Metco 450NS, 0.003 in./0.005 in. (0,076 mm/0,127 mm) in thickness.
- (2) Flame spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating or Metco 313NS 0.050 in. (1,27 mm) in thickness over the bond coating.
- E. Finish machine the seal lands (Ref.Fig. 401 and 402).
- F. Visually inspect the repair for integrity of the repair and continuity of sprayed edges.
- G. Mark the coating identification symbols, Sherritt-Gordon HA and NG or Metco HA and GA as applicable, using the electro-chemical or vibro-percussion marking technique detailed in 72-09-00 Repair.
- H. Identify repair (Ref.Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the bearing housing.

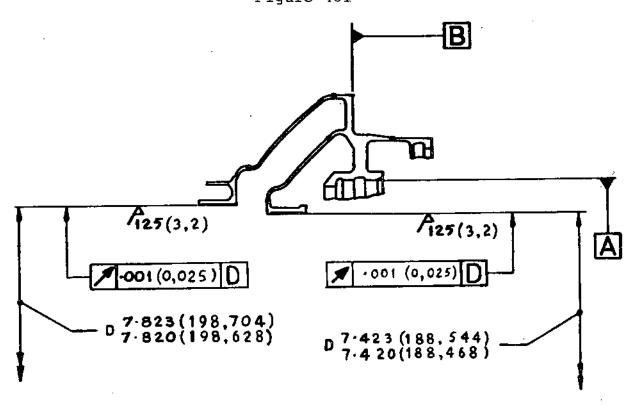
| REPAIR SCHEME NO. | BORE LOCATION (REF.FIG.403) | |
|----------------------|-----------------------------------|--|
| SAL B.470399 | Н | |
| SAL B.470400 | J | |

Repair Scheme Numbers Table 401



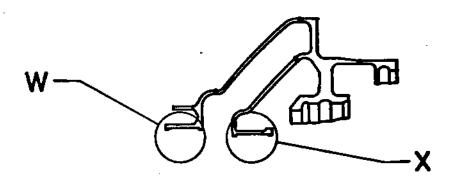


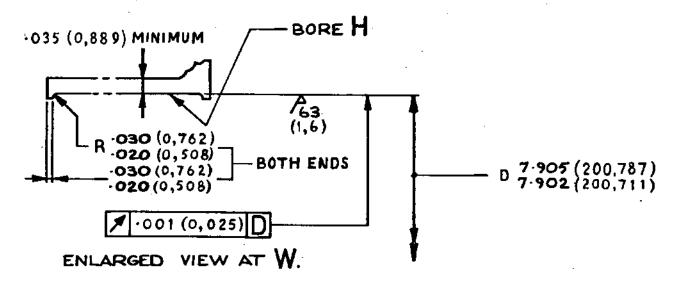
I.S.O. Collective Datum Figure 401

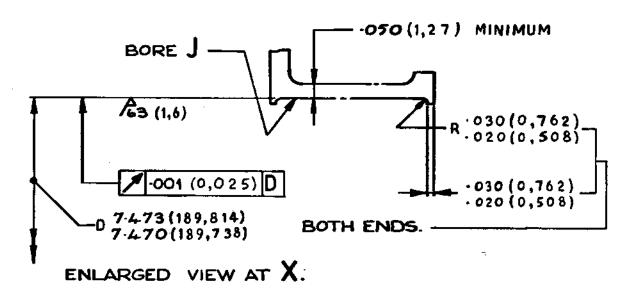


Standard Dimensions Figure 402 REPAIR
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Machining Dimensions Before Spraying Figure 403

72-51-01

Repair No.2 Page 404 Aug 1/75

HP TURBINE BEARING SUPPORT - REPAIR LABYRINTH RING SEAL LAND REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable_to:

Labyrinth Ring B.439918

Authority:

Modification No. OL.7507C

1. Introduction

- A. This Rapair describes the procedure for restoring the labyrinth ring seal land, in order to maintain the standard fin/ring clearances of labyrinth No.16. The defective location is first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. There is no restriction on the number of times this repair may be applied provided that specified dimensions are maintained.
- B. Verify that there is adequate material at the defective location to permit machining to the dimensions before spraying (Ref.para.3.B.).

3. Summary of Operations

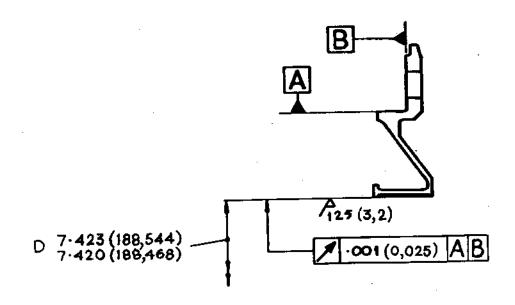
- A. Set the labyrinth ring true on datum diameter A and flange face B (Ref.Fig. 401).
- B. Machine the seal land to the specified dimensions (Ref.Fig. 402).
- C. Crack test the labyrinth ring with fluorescent-penetrant.

REPAIR

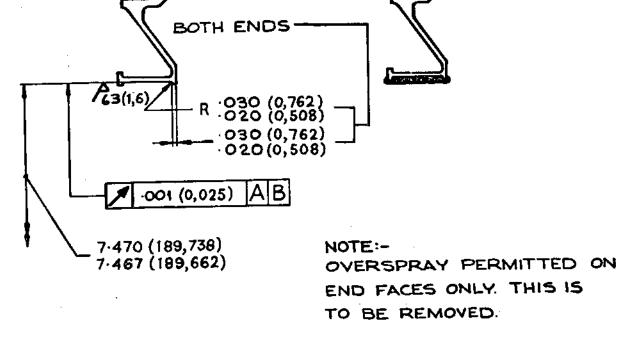


- D. Apply Abradable Coating (Ref.Fig.402).
 - (1) Combustion flame spray the prepared seal land with a bond coating of Metco 450NS, 0.003 in./0.004 in. (0,076 mm/0,102 mm) in thickness.
 - (2) Flame spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating or Metco 313NS 0.030 in. (0,762 mm) in thickness over the bond coating.
- E. Finish machine the seal land (Ref. Fig. 401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Mark the coating identification symbols, Sherritt-Gordon
 HA and NG or Metco HA and GA as applicable, using
 the electro-chemical or vibro-percussion marking technique
 detailed in 72-09-00 Repair.
- H. Identify repair. Mark the repair scheme number SAL 8.478070 close to the standard part number on the labyrinth ring.





Standard Dimensions Figure 401



Machining Dimensions Before Spraying and Spray Detail Figure 402

REPAIR

72-51-01 Repair No.3 Page 403 Aug 1/75

HP TURBINE BEARING SUPPORT - REPAIR LABYRINTH SHROUD SEAL LANDS REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Labyrinth Shrouds B.439935,

B.470513, B.927830

Authority:

Modification No. OL.7507C

1. Introduction

- A. This Repair describes the procedure for restoring the labyrinth shroud seal lands, in order to maintain the standard fin/shroud clearances of labyrinth No.17 and No.18. The defective locations are first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus in Table 401 and on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. There is no restriction on the number of times this repair may be applied provided that specified dimensions are maintained.
- B. One seal location, or both, may be restored at one repair.
- C. Verify that there is adequate material at each defective location to permit machining to the dimensions before spraying (Ref.para.3.B).

3. Summary of Operations

- A. Set the labyrinth shroud true on datum diameter A and face B (Ref.Fig. 401).
- B. Machine defective locations to the specified dimensions (Ref. Table 401 and Fig. 402).

REPAIR

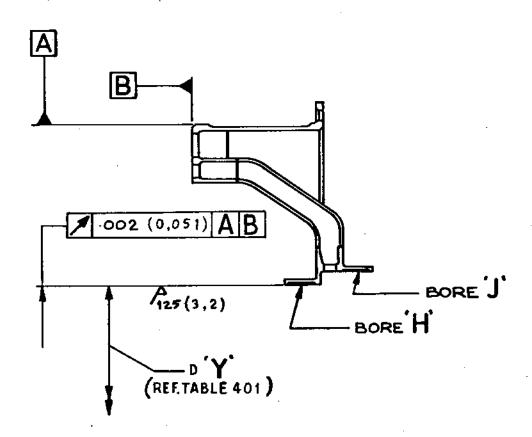
- C. Crack test the shroud with fluorescent-penetrant.
- D. Apply abradable coating (Ref.Fig.403).
 - (1) Combustion flame spray the prepared seal lands with a bond coating of Metco 450NS, 0.003 in./0.004 in. (0,076 mm/0,102 mm) in thickness.
 - (2) Flame spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating or Metco 313NS 0.040 in. (1,02 mm) in thickness over the bond coating.
- E. Finish-machine the seal lands (Ref.Fig.401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Mark the coating identification symbols, Sherritt-Gordon
 (A) and (NG) or Metco (HA) and (GA) as applicable, using
 the electro-chemical or vibro-percussion marking technique
 detailed in 72-09-00 Repair.
- H. Identify repair (Ref.Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the labyrinth shroud.

| REPAIR SCHEME NO. | BORE LOCATION | DIAMETER 'X' (REF.FIG.401 | DIAMETER 'Y' AND 402) |
|-------------------------|------------------|------------------------------------|------------------------------------|
| SAL B.478075 | н | 7.883 (200,228) 7.880 (200,152) | 7.827 (198,806) 7.824 (198,730) |
| SAL B.478076 | J | 8.383 (212,928) 8.380 (212,852) | 8.327 (211,506) 8.324 (211,430) |

Before Spraying and Standard Dimensions Table 401

REPAIR
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Repair No.4
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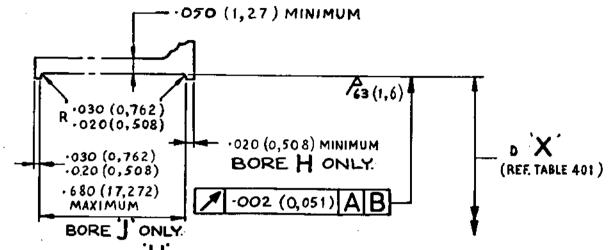




Standard Dimensions Figure 401

72-51-01 Repair No.4 Page 403 Aug 1/75





VIEW AT BORE HIS SIMILAR BUT OPPOSITE HAND.

Machining Dimensions Before Spraying Figure 402



OVERSPRAY IS PERMISSIBLE ON END FACES ONLY, AND MUST NOT EXTEND BEYOND DIMENSION SHOWN: ALL OVERSPRAY IS TO BE REMOVED.

Spraying Detail Figure 403

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Repair No.4
Page 404
Aug 1/75



HP TURBINE BEARING SUPPORT OUTER AIR DUCT - REPAIR - RESTORATION OF THE BORE DIAMETER

MODIFICATION OLY. 8680C

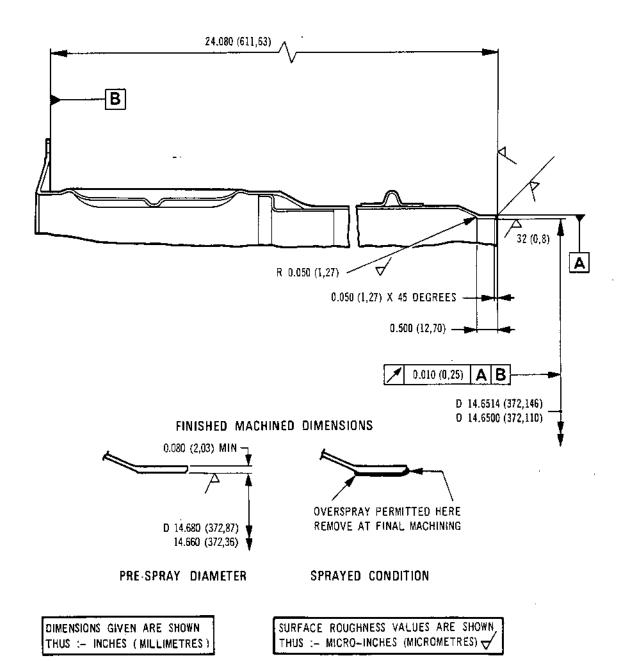
1. Effectivity

| I.P.C. | FIG./ITEM | PART NO. |
|----------|----------------------|--|
| 72-51-01 | 1 A 270C 1 A 270D | B.932751 to B.932758 B.933270 to B.933277 |
| | 1 A 270E | B.934452 to B.934457 B.935710 to B.935719 B.936886 to B.936891 |

Introduction

A. General.

- (1) This repair describes the procedure to restore the bore diameter by grinding oversize then flame spraying with plasma and finally grinding to size.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair for all standard practices applicable to this repair procedure.
- (4) Details of the tools, referred to by item number in this repair procedure, can be found in para.4.
- (5) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (6) Surface texture to be 125 micro inches (3,2 micro millimetres) unless otherwise stated.
- (7) Tolerances on all machined dimensions are plus/minus 0.010 in. (0.25 mm) unless otherwise stated.
- (8) Toterances on all angles are plus/minus 2 degrees unless otherwise stated.



Machining and Plasma Deposition Dimensions Figure 401

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3. Instructions

A. Machine Bore.

- (1) Locate the duct in grinding fixture, Ref. tool item 1, then locate duct/fixture assembly to a grinding machine and true up to datums A and B.
- (2) Grind the 14.650 in. (372,11 mm) bore to 14.680/ 14.660 in. (372,87/372,36 mm) pre-spray diameter. The minimum wall thickness is 0.080 in. (2,03 mm). (Ref. Fig. 401).
- (3) Remove the duct/fixture assembly from the grinding machine and the duct from the fixture.
- (4) Visually inspect the component to ensure the grinding parameters have been produced.

B. Crack Detect.

(1) Crack test the component using the fluorescent dye penetrant technique specified for this component in Chapter 72-51-01 Inspection/Check.

C. Abrasive Blast.

- (1) Vapour degrease the duct using the technique specified in Chapter 72-09-11 Repair.
- (2) Completely mask the duct using a suitable masking tape, except the area to be plasma sprayed, (Ref. Fig. 401).
- (3) Abrasive blast the area to be sprayed using the technique specified in Chapter 72-09-11 Repair.

D. Plasma Spray.

- (1) Plasma flame spray the area indicated in Fig.401 using the technique specified in Chapter 72-09-11 Repair, to a thickness of 0.015/0.020 in. (0,38/0,58 mm) using spraying medium MSRR 9507/3.
- (2) Visually inspect the spray deposit using the technique specified in Chapter 72-09-11 Repair.

E. Finish Grind.

- (1) Locate the duct in grinding fixture, Ref. tool item 1, then locate the duct/fixture assembly to a grinding machine, and true up to datums A and B (Ref.Fig. 401).
- (2) Finish grind the sprayed diameter to the dimensions shown in Fig. 401. Remove any overspray.
- F. Crack Detect the Plasma Deposition.
 - (1) Test for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.
- G. Identify.
 - (1) Mark salvage B.492081 or R6 close to the existing part number using the electro-chemical marking technique as specified in Chapter 72-09-00 Repair.
- H. Finally Inspect.
 - (1) Finally inspect the component to ensure the repair has been carried out satisfactorily and that the component is in a serviceable condition.
 - (2) Generally clean the component to remove grease and foreign bodies, then place the component in a protective container and store as required.

4. Tools, Fixtures and Equipment

| Description | <u>Quantity</u> | Tool No. | Item |
|------------------|-----------------|--------------|------|
| Grinding Fixture | 1 | S3S.15773000 | 1 |

TN 3642



HP TURBINE BEARING SUPPORT - REPAIR LABYRINTH COVER AIR TUBE HOUSINGS REPAIRED BY REPLACING THE AIR TUBE HOUSINGS. MODIFICATION NO. OL.8830C

1. Effectivity

I.P.C.

Fig./Item No.

Part No.

72-51-01

4/180B

8.490182

Introduction

A. General

- (1) This repair describes the procedure to restore the No.13 labyrinth cover assembly to a serviceable condition by replacing the worn No.4 bearing cooling air tube housings.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair for all standard practices applicable to this repair procedure.
- (4) Details of the tools, referred to by item number in this repair procedure, can be found in para.4.
- (5) Remove sharp edges 0.004 to 0.020 in. (0,1 to 0,5 mm) unless otherwise stated.
- (6) Surface texture to be 125 microinches (3,2 micrometres), unless otherwise stated.

3. Instructions

- A. Grind spray coating
 - (1) Locate the cover in grinding fixture, Ref. tool item 1, then locate the cover/fixture assembly to a grinding machine and true up to datum B.
 - (2) Grind diameter AD to remove spray coating.



- (3) Remove the cover/fixture assembly from the grinding machine and the cover from the fixture.
- (4) Visually inspect to ensure the satisfactory completion of the grinding operation.

B. Remove chrome plate

- (1) Vapour degrease the cover using the technique specified in Chapter 72-09-11 Repair.
- (2) Remove the chrome plate from diameter AE (Ref.Fig.402) by immersing in stripping solution 'A'; refer to 72-09-07 Repair for procedure.

Remove the cover when stripping is complete.

NOTE: The chrome plate can alternatively be removed by grinding.

C. Heat treatment

(2) Position the cover in a furnace. Heat treat the cover in an argon or hydrogen atmosphere to a temperature of 1020 deg C plus/minus 10 deg C. Soak at this temperature for 30 minutes. Cool to 700 deg C in not more than 8 minutes.

D. Inspect

(2) Inspect for the satisfactory completion of the heattreatment.

E. Remove worn housing

(1) Cut off the worn tube housing and trim back to restore the weld preparation to a height of 3.240/3.250 in (82,30/82,55 mm) (Fig. 401).

f. Inspect

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(1) Test for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.



6. Weld replacement housing

- (1) Assemble replacement housing B.348682 PM1 to the cover and tackweld diametrically opposite, using filter rods to specification MSRR 9500/200.
- (2) Check for distortion. True up any distortion using conventional hand tools.
- (3) Square butt weld replacement housing to cover using hand held argon arc welding and filler rods to specification MSRR 9500/200 (Ref.Fig.402). Weld all round.
- (4) Check for distortion. True up any distortion using conventional hand tools.
- (5) Remove existing shank nuts. Ref.72-09-00 Repair.

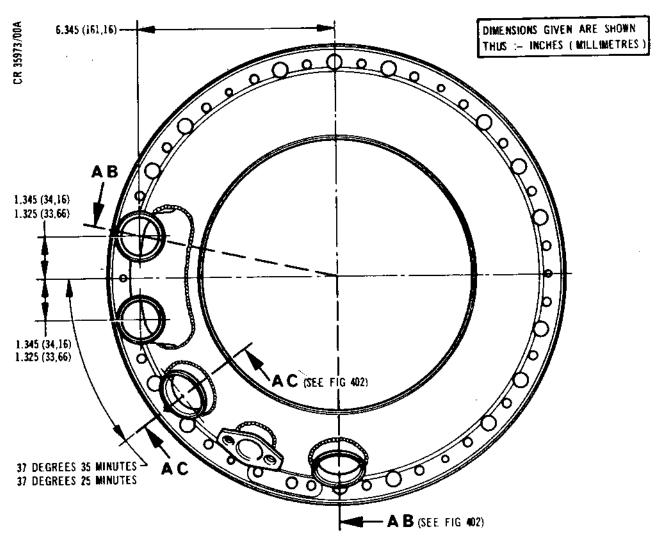
H. Inspect

- (1) Check for the satisfactory completion of the previous operations.
- (2) Test for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.
- (3) Carry out a non-destructive radiological (X-ray) test on the component; this is a group 1 weld.

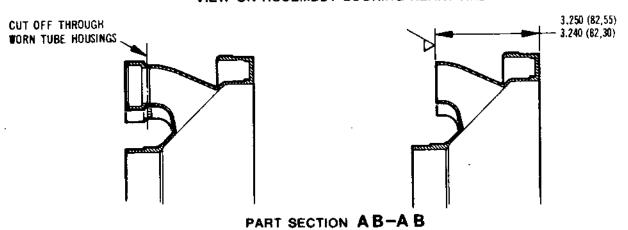
J. Post Weld Heat Treatment

- (1) Position the cover in a furnace. Heat treat the cover in an argon or hydrogen atmosphere to a temperature of 1020 deg C plus/minus 10 deg C. Soak at this temperature for 30 minutes. Cool to 700 deg C in not more than 8 minutes.
- (2) Place the cover in the furnace. Heat treat the cover to a temperature of 800 deg C. Soak at this temperature for 2 hours. Remove cover from furnace and cool slowly in air.









Standard Dimensions and Housing Removal Details Figure 401

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- (3) Place the cover in the furnace. Heat treat the cover to a temperature of 700 deg C plus/minus 10 deg C. Soak at this temperature for 16 hours. Remove cover from furnace and cool slowly in air.
- (4) Visually inspect the component for distortion. True up any distortion using conventional hand tools.

K. Inspect

(1) Test for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.

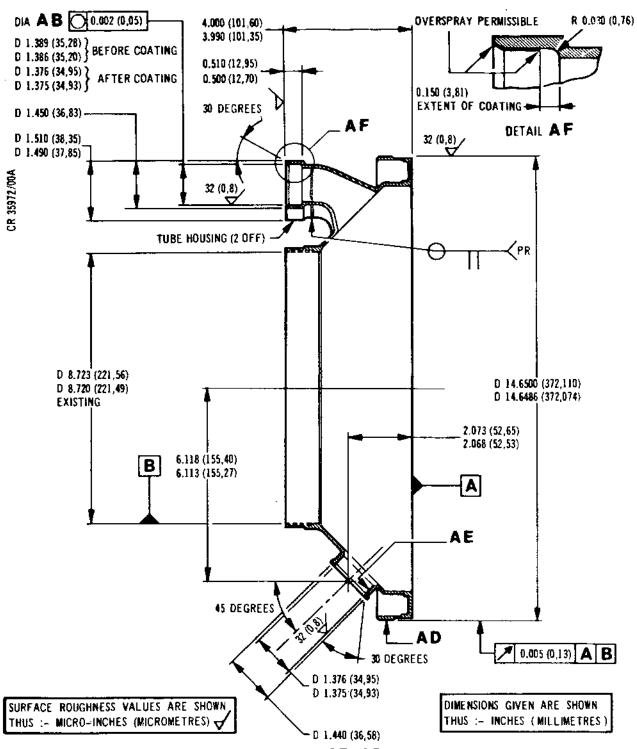
L. Machine

- (1) Assemble the cover to the fixture, Ref. tool item 1.
- (2) Face off the replacement housing to produce 4.000/3.990 in (101,60/101,35 mm) dimension (Ref.Fig.401) using 6.345 in (161,16 mm) and 1.325/1.345 in (33,66/34,16 mm) co-ordinates from the vertical and horizontal centre lines. (Ref.Fig.401).
- (3) Bore to produce the 1.386/1.389 in (35,20/35,28 mm) pre-spray diameter to a depth of 0.500/0.510 in (12,70/12,95 mm). Produce the 0.030 in (0,76 mm) radius, (Ref.Fig.402 Detail AF).
- (4) Produce a 30 deg chamfer on the 1.450 in (36,83 mm) diameter. (Ref.Fig.402).
- (5) Machine the tube outside diameter to produce 1.510/1.490 in (38,35/37,85 mm) dimension.
- (6) Carefully remove any burrs.

M. Inspect

- (1) Check for the satisfactory completion of the machining operations.
- (2) Test new housings only for cracks using the fluorescent dye penetrant process specified for this component in 72-51-01 Inspection/Check.





SECTION AB-AB
PART SECTION AC-AC SIMILAR (SEE FIG 401)

No.13 Labyrinth Cover Repair Details Figure 402

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N. Chrome plate

- (1) Chrome plate diameter AE (2 locations similar) shown in Fig.402. Ensure 0.001/0.0015 in (0,03/0,04 mm) plating thickness. Refer to 72-09-07 Repair, for chrome plate procedure.
- (2) Visually inspect the component to ensure that the plating is free from blisters, excessive roughness, deep pitting and coarse cracking.
- (3) Check the plate thickness using appropriate approved methods.
- P. Plasma spray or detonation flame deposition
 - (1) Plasma spray
 - (a) Plasma flame spray diameter AB (Ref.Fig.402) using MSRR 9507/1 spray medium. Refer to 72-09-11 Repair for plasma spray procedure.
 - (b) Visually inspect the plasma spray deposit using the technique specified in Chapter 72-09-11 Repair.
 - (2) Detonation flame deposition
 - (a) Detonation flame deposition diameter AB (Ref.Fig.402) using MSRR 9507/1 as the medium. Refer to 72-09-26 Repair for detonation flame deposition procedure and masking.
 - (b) Visually inspect the detonation flame deposit using the technique specified in Chapter 72-09-26 Repair. Remove masking.

R. Plasma spray

- (1) Plasma flame spray diameter AD (Ref.Fig.402) using MSRR 9507/3 spray medium. Refer to Chapter 72-09-11 for plasma spray procedure and masking.
- (2) Visually inspect the plasma spray deposit using the technique specified in Chapter 72-09-11 Repair. Remove masking.



S. Finish machine. Ref.Fig.402

- (1) Assemble the cover to the fixture, Ref. tool item 1, and the cover/fixture assembly to the machine.
- (2) Finish bore the 1.375/1.376 in (34,93/34,95 mm) diameter AB.
- (3) Remove the cover/fixture assembly from the machine and the cover from the fixture.
- (4) Inspect for the satisfactory completion of para (2).
- (5) Check for cracks using the fluorescent dye penetrant process specified for this component in 72-51-01 Inspection/Check.
- (6) Assemble the cover to the fixture, Ref. tool item 1, and the cover/fixture assembly to the machine.
- (7) Finish grind 14.6500/14.6486 in (372,110/372,074 mm) diameter AD.
- (8) Remove the cover/fixture assembly from the machine and the cover from the fixture.
- (9) Inspect for the satisfactory completion of para. (7).
- (10) Check for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.

T. Assemble shank nuts

- (1) Assemble new shank nuts AS27858 to the cover and swage to retain. Refer to Chapter 72-09-00 Repair for procedure.
- (2) Inspect to ensure the satisfactory completion of para.(1); refer to 72-D9-00 Repair.



- U. Identify repair
 - (1) Mark 'SAL.B497478' or 'R7' adjacent to existing assembly number using the vibro-percussion engraving technique (Ref.72-09-00 Repair).
 - (2) Inspect to ensure the satisfactory completion of para.(1).
- v. Finally Inspect
 - (1) Finally inspect the cover to ensure the repair has been carried out satisfactorily and that the cover is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

A. The following tools, fixtures and equipment are required to complete this repair.

| Description | <u>Quantity</u> | Tool No. | <u>Item No.</u> |
|----------------------|-----------------|--------------|-----------------|
| fixture machining | 1 | S3S 14417000 | 1 |

5. Replacement Parts

| Description | Quantity | Part No. | IPC Fig./Item |
|----------------|----------|------------|-----------------|
| Nut, Self | 2 (max) | AS27858 | 72-51-01 4 190A |
| locking, Shank | 2 (max) | 8348682PM1 | - |



HP TURBINE BEARING SUPPORT - TUBE ELBOW BORES RESTORED BY RENEWING THE EXISTING ANTI-FRET COATING

MODIFICATION NO. OL.8889C

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u>
72-51-01 3 140 B490180 8490181

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the bores of the tube elbow by machining out the defective coating, applying a new coating and machining to size.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. Instructions

Note: If both bores are defective, then the following operations may be repeated for the second bore at the same time.

A. Machine Bore.

- (1) Locate grinding fixture ref. tool item 1 to a grinding machine.
- (2) Locate the tube elbow to the fixture and set true.
- (3) Grind to remove the defective coating from the bore, removing the minimum amount of material.
- (4) Remove any minor_residue of the coating by hand dressing if necessary.
- (5) Remove burrs and sharp edges.

B. Inspect.

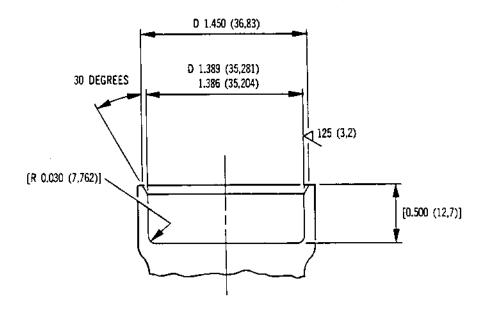
- (1) Inspect for the satisfactory completion of the grinding operation.
- (2) Crack test the tube elbow using the dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.

C. Apply Coating.

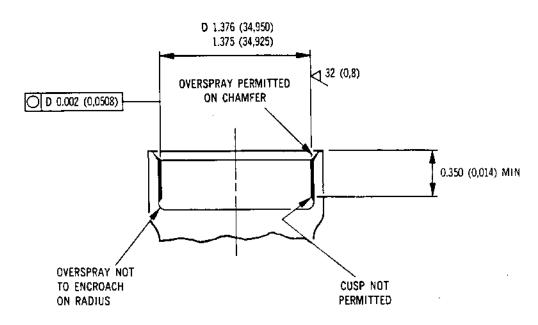
- (1) Mask off the areas not being coated (Ref. Fig. 401).
- (2) Dry abrasive blast the areas to be coated using 18/24 mesh aluminium oxide grit as instructed in TSD 594 OP104.
- (3) Apply an anti-fret coating to the bore.

NOTE: Alternative processes are given in paragraphs (a) and (b).

(a) Apply Metco 73 SF (MSRR9507/1) as instructed in TSD 594 OP704.



MACHINING DIMENSIONS BEFORE COATING



FINISH MACHINING DIMENSIONS

DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Tube Elbow Machining Details Figure 401

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Repair No.8
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(b) Apply LW-IN40 as instructed in TSD 594 0P704 Section 2A (3).

The coating must be of sufficient thickness to enable machining to finished bore size of 1.376/1.375 in. (34.95/34.93 mm).

D. Inspect.

(1) Visually inspect the coating for cracking or lack of adhesion, using 7x magnification, as instructed in TSD 594 0P704.

E. Machine.

- (1) Locate grinding fixture ref. tool item 1 to a grinding machine.
- (2) Locate the tube elbow to the fixture and set true.
- (3) Finish grind the bore to obtain the 1.376/1.375 in. (34,95/34,93 mm) diameter (Ref. Fig. 401).

F. Inspect.

- (1) Inspect for the satisfactory completion of the grinding operation.
- (2) Crack test the tube elbow using the dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.

G. Identify.

(1) Mark SAL.B.506296 or R8 adjacent to the existing assembly number, using electro-chemical or vibro-percussion marking.

H. Final Inspection.

(1) Finally inspect the tube elbow to ensure that the repair has been carried out satisfactorily and that the tube elbow is in a serviceable condition.



4. Special Tools, Fixtures and Equipment

Description Qty Tool No. Item

Grinding fixture 1 \$3\$15346000 1

5. Replacement Parts

None.



HP TURBINE BEARING SUPPORT - INSULATED TUBE ASSEMBLY REPAIRED BY REPLACING ANTI-FRET COATING

MODIFICATION NO. OL.8891C

1. Effectivity

| I.P.C. | <u> Fig./</u> | <u>Item</u> | <u>Part</u> | No. |
|----------|---------------|-------------|----------------------|-----|
| 72-51-01 | 3 3 | 30 70 | B490189, B490185, | |

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the tube spherical ends by removing the existing coating, applying a new coating and machining to size.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. Instructions

A. Machine.

- (1) Locate the tube assembly on a grinding machine using suitable locks and clamps, and set true to the spherical end.
- (2) Grind the spherical end to remove the existing antifret coating, to the dimensions given in Figure 401.
- (3) Remove burrs and sharp edges.
- (4) Repeat operations (1), (2) and (3) for the opposite end spherical location.

B. Inspect.

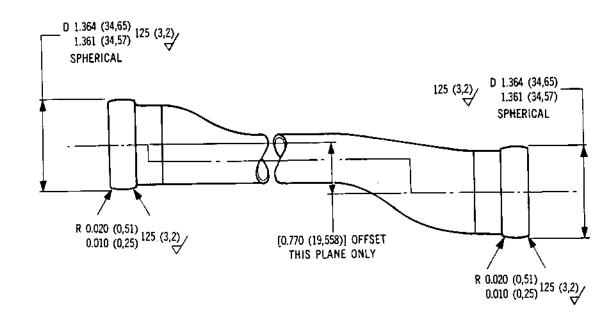
- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Crack test the tube assembly using the dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.

C. Apply Coating.

- (1) Mask off the areas not to be coated.
- (2) Dry abrasive blast the areas to be coated as instructed in TSD 594 0P704.
- (3) Apply Metco 73 SF (MSRR9507/1) to the spherical ends as instructed in TSD 594 0P704.

D. Inspect.

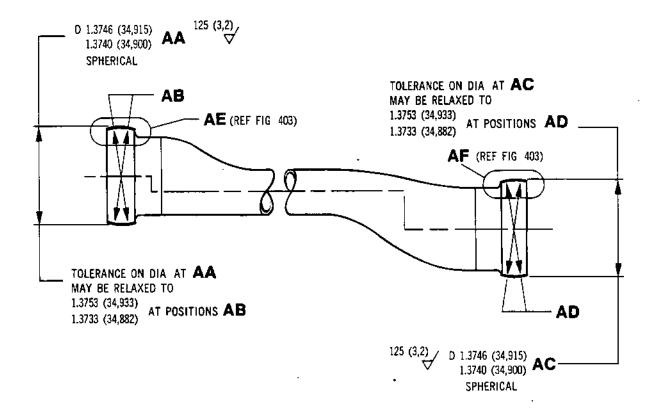
(1) Inspect the coating visually using 7x magnification, for cracking or lack of adhesion, as instructed in TSD 594 0P704. CR 36122/00A



SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Tube Assembly Machining Details Figure 401

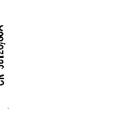


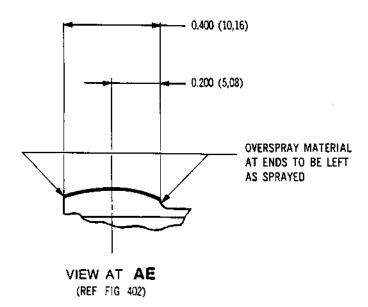
DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

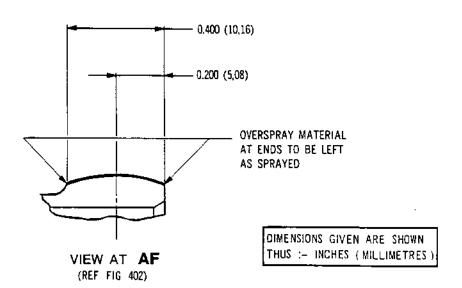
SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Tube Assembly Finish Machining Figure 402

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Spherical End Details Figure 403

E. Machine.

- (1) Locate the tube assembly on a grinding machine using suitable blocks and clamps, and set true to the spherical end.
- (2) Finish grind the coating to obtain the dimensions given in Figures 402 and 403.
- (3) Remove burrs and sharp edges.
- (4) Repeat operations (1), (2) and (3) for the opposite end spherical location.

F. Inspect.

(1) Inspect for the satisfactory completion of the machining operation.

G. Identify.

(1) Mark SAL.B.507160 or R9 adjacent to the existing assembly number, using electro-chemical or vibro-percussion marking as instructed in Chapter 72-09-00 Repair.

H. Final Inspection.

(1) Finally inspect the tube elbow to ensure that the repair has been satisfactorily carried out and that the tube assembly is in a serviceable condition.



- 4. Special Tools, Fixtures and Equipment
 None.
- 5. Replacement Parts
 None.



HP TURBINE BEARING SUPPORT - INSULATED TUBE ASSEMBLY RESTORED BY REPLACING THE SPHERICAL TUBE ENDS

MODIFICATION No. 01.8890C

1. Effectivity

| <u>I.P.C.</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|---------------|------------------|--|
| 72-51-01 | 3 30 3 70 | B.490189, B.496201 B.490185, B.496204 |

Introduction

A. General

- (1) This repair describes the procedure to restore the insulated tube assemblies by removing the spherical tube ends and welding on replacement tube ends.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0.51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.



3. Instructions

- A. Remove LH Tube End.
 - (1) Assemble the left-hand cut-off block to fixture ref.tool item 1 (Ref.Fig.403).
 - (2) Locate the tube assembly to the fixture and push tight (with the right-hand plunger) to the cut-off block and clamp the tube assembly to the fixture, then saw through the tube assembly close to the cut-off block with a hacksaw to remove the end spherical, and file the tube end flat and square (Ref.Fig.401).
 - (3) Remove the tube assembly from the fixture, and prepare the sawn end for welding on the replacement end spherical.
 - (4) Remove the cut-off block from the fixture.
- B. Weld Replacement End.
 - (1) Clamp the tube assembly in position on the fixture ref. tool item 1.
 - (2) Place the new end spherical B.490187 in position on the Left-hand plunger, using the dowel on the chain to locate the lug to the appropriate side of the tube assembly (Ref.Figs.402 and 403).

NOTE: If necessary, pack underneath the duct assembly to obtain a good joint.

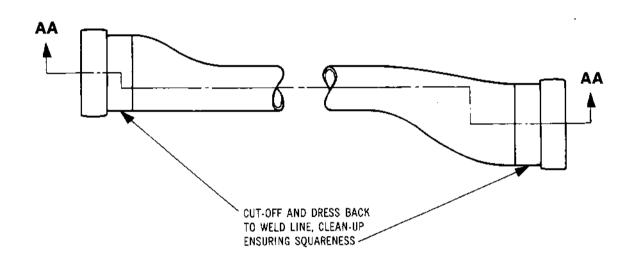
(3) Weld the end spherical to the tube assembly using the following details:

NOTE: This is a group 1 weld and must conform to D.Eng.R.D.2300.

Manual Method of welding 250 amp Rectifier Machine Air cooled Torch 20-25 amps Current . . 3/32 in. (2,3813 Electrode mm) dia tungsten MS 950/3 20 swg Filler wire 20 cu ft/hr or Argon to torch.. 9-1D litres/min 25 cu ft/hr or Backing.. 11-12 litres/min

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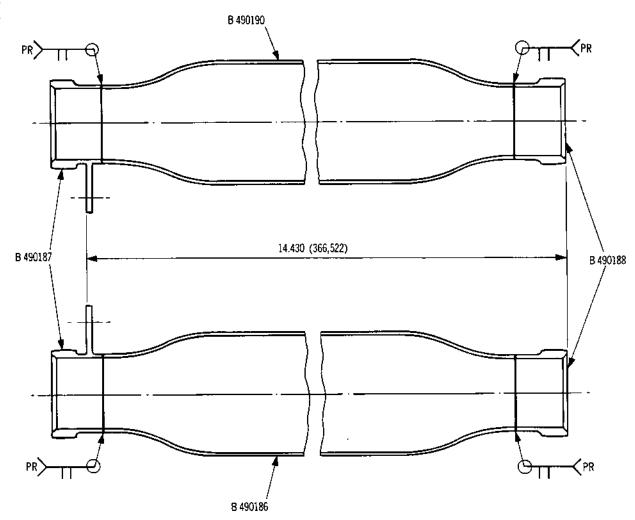
CR 36125/00A



Insulated Tube Assembly Figure 401



CR 36126/00A



SECTION AA-AA

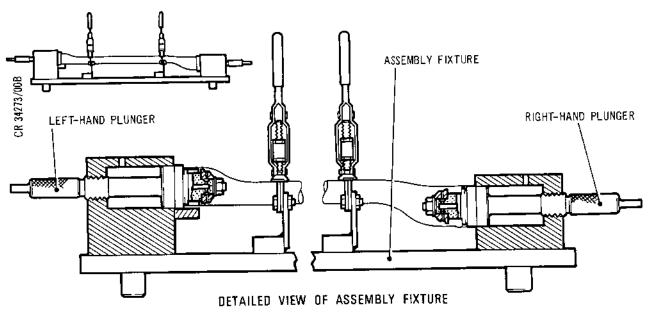
(REF FIG 401)

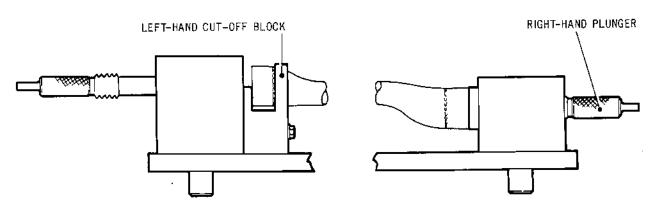
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Spherical Tube End Welding Figure 402

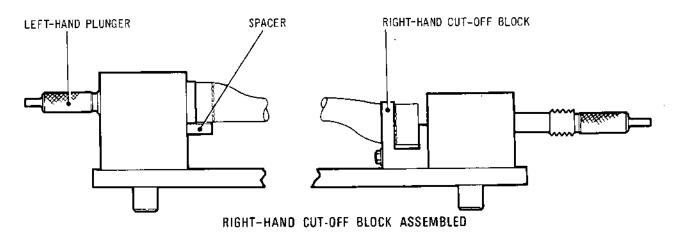
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LEFT-HAND CUT-OFF BLOCK ASSEMBLED



Assembly Fixture Figure 403

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Special Instructions.

- (i) Tackweld end fittings in six equi-spaced positions.
- (ii) Remove component from fixture.
- (iii) Remove 'Argon Backing Plunger' from fixture, and use to obtain argon under-flow.
- (iv) Weld complete.

NOTE: Crater eliminator or variable amp control to be used at all times.

- C. Remove RH Tube End.
 - (1) Assemble the right-hand cut-off block to fixture ref.tool item 1 (Ref.Fig.403).
 - (2) Locate the tube assembly to the fixture and push tight (with left-hand plunger) to the cut-off block and clamp the tube assembly to the fixture, then saw through the tube assembly close to the cut-off block with a hacksaw to remove the end spherical, and file the tube end flat and square (Ref. Fig. 401).
 - (3) Remove the tube assembly from the fixture, and prepare the sawn end for welding on the replacement end spherical.
 - (4) Remove the cut-off block from the fixture.
- D. Weld Replacement End.
 - (1) Assemble the spacer to the fixture (Ref.Fig.403).
 - (2) Clamp the tube assembly in position on the fixture, ensuring that the lug at the left-hand end is pushed tight against the spacer.



(3) Place the new end spherical B.490188 in position on the right-hand plunger (Ref. Figs. 402 and 403).

NOTE: If necessary, pack underneath the tube assembly to obtain a good joint.

NOTE: Overall length is correct when the shoulder of the right-hand plunger is between the steps on the plunger guide block. Adjust tube assembly length if necessary.

(4) Weld the end spherical to the tube assembly (refer to para.3.B(3) for details).

E. Inspect.

- (1) Crack test the tube assembly using the dye penetrant process specified for this component in Chapter 72-51-01 Inspection/Check.
- (2) Visually inspect and identify the welded joints for X-ray.
- (3) Radiologically (X-ray) inspect the tube for welding defects, ensuring that a minimum film density of 1.5 is achieved at the weld.

F. Pressure Test.

(1) Using the pressure test fixture ref.tool item 2, test the tube assembly for two minutes at 32 psi (230 kPa), using either water or paraffin. After two minutes inspect the tube assembly for leaks. Remove the tube assembly from the fixture.

G. Clean.

(1) Immerse the tube assembly in Ardrox 185 (refer to Chapter 72-09-00 Cleaning) for 30 minutes, followed by a cold swill, hot swill, blow through and dry.



- H. Identify.
 - (1) Mark SAL B.507159 or R10 adjacent to the existing part number using electro-chemical or vibro-percussion marking (Ref.72-09-00 Repair).
- J. Final Inspection.
 - (1) Finally inspect the tube assembly to ensure that the repair has been carried out satisfactorily and that the tube assembly is in a serviceable condition.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | Part No. | <u>Item No.</u> |
|--------------------------|-----------------|---------------|-----------------|
| Assembly Fixture | 1 | s3s15349000 | 1 |
| Pressure Test Fixture | 1 | \$3\$15348000 | 2 |

5. Replacement Items

| Description | <u>Quantity</u> | Part No. |
|--------------------|-----------------|----------|
| Spherical Tube End | 2 | B.490187 |
| Spherical Tube End | 2 | B.490188 |



DUCT A/O AIR PROVISION FOR RESTORATION OF FRETTED INTERNAL DIAMETERS OF SEAL CARRIERS

REPAIR NO. B513510

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-51-01

02 060A

B445840

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Maximum repairable diameter of sealing bores marked BA, BB and BC is 4.282 (108,76) (refer fig.402 and 403).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Set component in a suitable machine and set true to datum A and correct angle position. Machine bores marked BA, BB and BC to dimensions shown as required.

Refer fig. 401, 402 and 403

2) Dimensionally inspect.

Refer fig.403

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3) Crack detect repair area.

Refer Overhaul Manual Chapter 72-51-01 Inspection/Check.

4) Mask off areas not to be coated and spray machined bore with bond coat to a thickness of 0.003/0.005 (0,076/0,127).

Spray top coat to a thickness sufficient to produce final dimensions.

Refer fig.403 and 404 Refer TSD 594 OP.704 Bond Coat MSRR9507/5 (Metco 450 NS). Top Coat MSRR9507/3 (Metco 45C-NS).

5) Visually inspect coating for defects.

Refer TSD 594 OP.704 Section 8.

6) Set component in a suitable machine set true to datum A and correct angle position. Machine bores marked BA, BB and BC to dimensions shown. Refer fig.401, 402, 404 and 405

7) Dimensionally inspect.

Refer fig.404 and 405

8) Visually inspect coating for defects.

Refer TSD 594 OP.704 Section 8.

9) Mark on SAL B513510 or R11 and coating identity symbols CO HA adjacent to existing part number using vibro-percussion engraving. Refer Overhaul Manual Chapter 72-09-00 Repair.

MATERIAL

COMPONENT

MATERIAL

BSEM 661

RR CODE

DUCT A/O AIR

NICKEL BASED ALLOY PE.11

N/A

6. DATA

NONE.

7. TOOLS.

NONE.

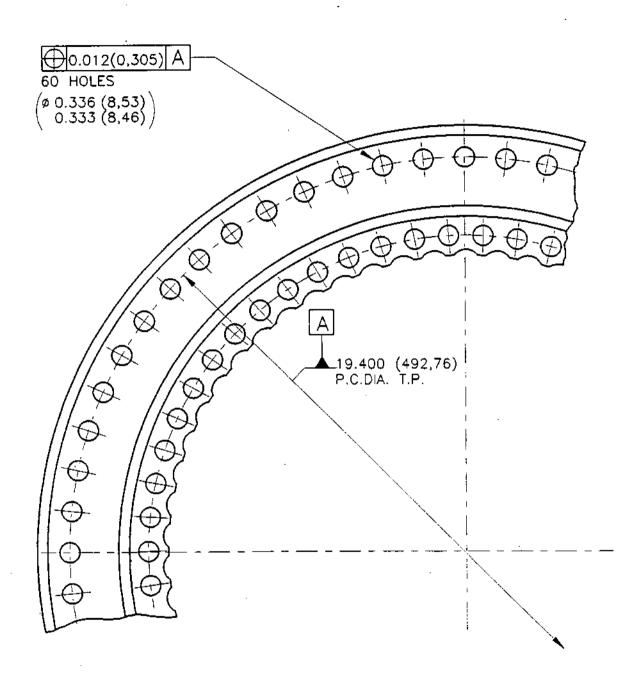


8. REPLACEMENT PARTS

NONE.

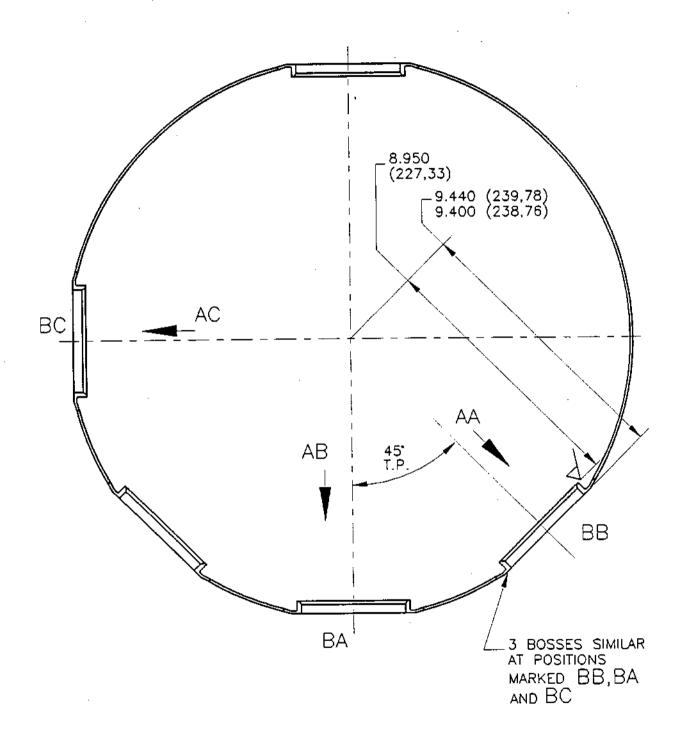
72-51-01 Repair No. 11 Page 403 Dec 1/91





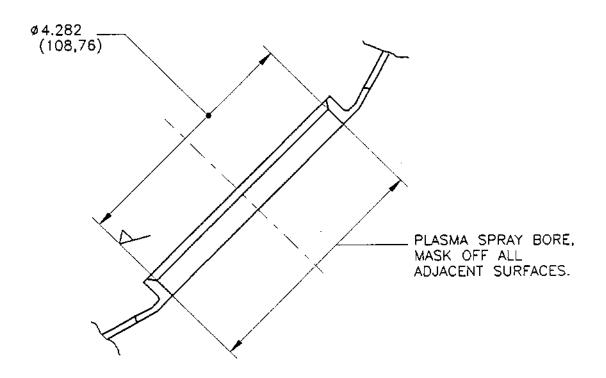
VIEW ON DUCT A/O AIR FRONT FACE FIG.401

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GENERAL SECTION THROUGH DUCT A/O AIR FIG.402

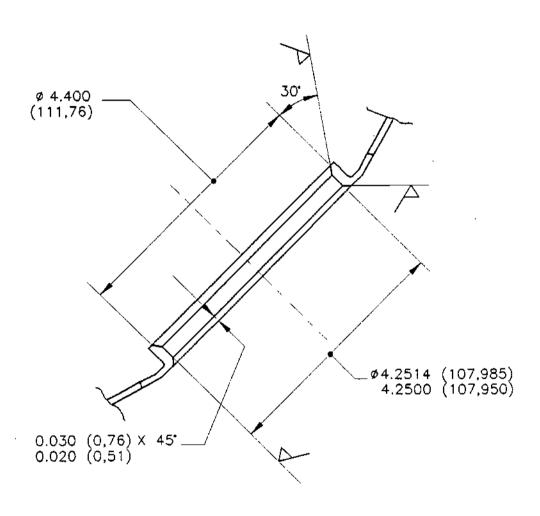
72-51-01 Repair No. 11 Page 405 Dec 1/91



VIEW AT BA AND BC SIMILAR

SECTION SHOWING PRE-SPRAY MACHINING FIG. 403

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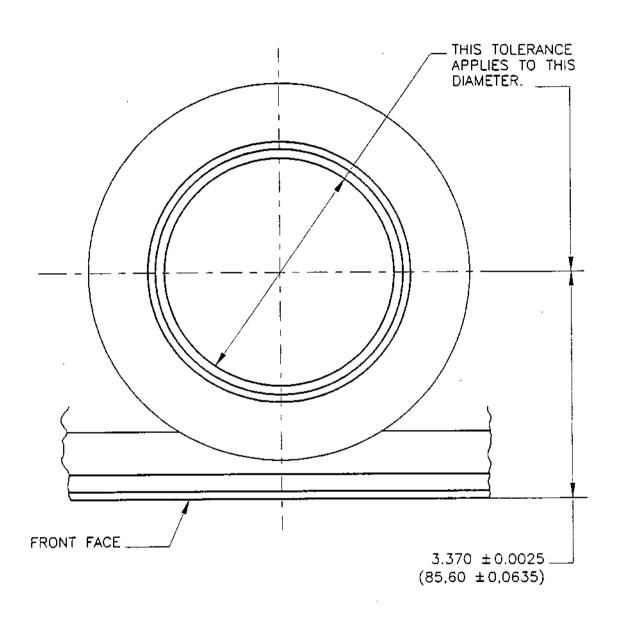


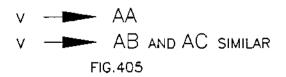
VIEW AT BA AND BC SIMILAR

SECTION SHOWING POST-SPRAY MACHINING FIG.404

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72-51-01 Repair No. 11 Page 408 Dec 1/91



HOUSING, ASSEMBLY OF, BEARING

REMOVAL OF DISTORTION FROM REAR FLANGE BY MACHINING

REPAIR NO. B515001

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|-----------------|
| 72-51-01 | 4 /380A | B451076 |
| 12 01 01 | | B916346 |
| | | . В919777 |
| | | В919779 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be embodied any number of times provided stated limits are maintained (Refer fig. 401).

Temporary re-protection of components between operations should be carried out in accordance with TSD 594 0P.340.

GENERAL 3.

UNLESS OTHERWISE SPECIFIED Drawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimetres) Tolerances on machined dimensions plus/minus 0.010 (0,25) Tolerance on angles plus/minus 2 degrees Break sharp edges 0.004 to 0.020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 63 (1,6) Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Locate component to machine and Refer Fig. 401. set true to datums.

REPAIR 72-51-01 Repair No. 12 Page 401 Jan 4/93



2) Machine to remove distortion. Remove minimum material. NOTE: Machine lay on Face AC to be concentric with component centerline. Surface finish to be measured radially. Refer Fig. 401.

3) Dimensionally inspect.

Refer Fig. 401.

4) Machine to restore hole chamfer(s) and/or flange chamfer if outside stated limits. Refer Fig. 401.

- Remove from machine, de-burr and break sharp edges.
- 6) Locally crack detect.

Refer Overhaul Manual Chapter 72-51-01 Inspection/Check.

7) Mark Repair Instruction number RI B515001 or R12 on component adjacent to the normal 'assy.of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig.401 for location of identity marking.

MATERIAL

COMPONENT

MATERIAL

RR CODE

HOUSING, ASSEMBLY OF, BEARING.

NIMONIC ALLOY BSEM 660

_-

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

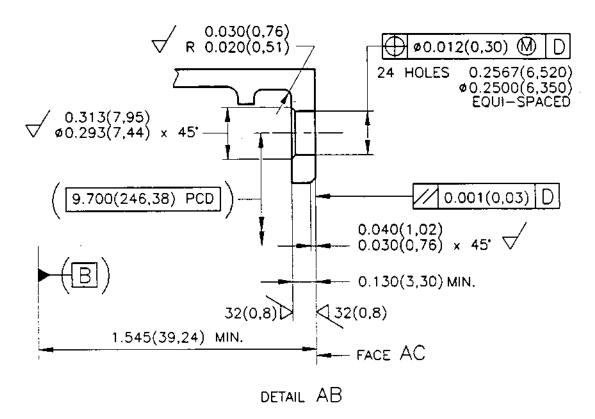
QUANTITY

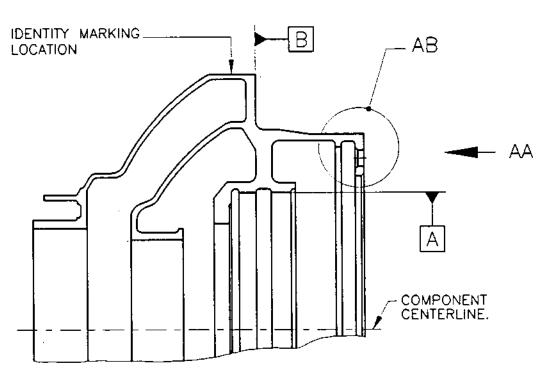
ITEM

NONE.

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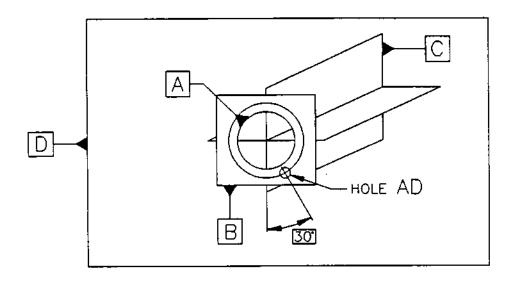


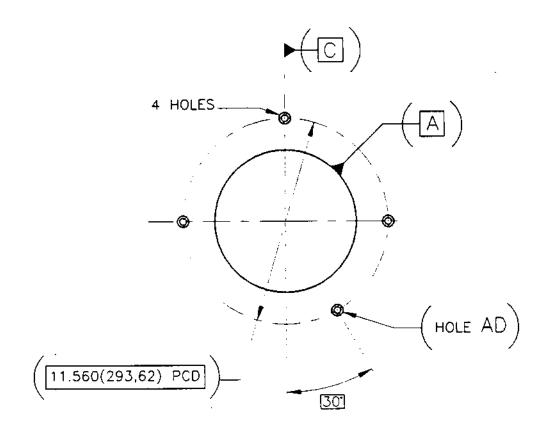


TYPICAL SECTION THROUGH HOUSING. FIG. 401

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DIAGRAMMATIC V — AA FIG.402

REPAIR

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British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-525

Insert in 72-51-01 at rear of repair section in RST No. order

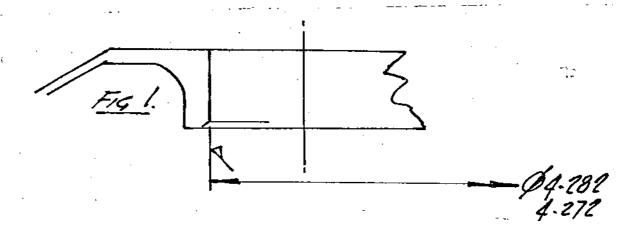
REASON FOR ISSUE:

Air duct assembly - repair fretting at the internal diameters of the seal carrier housing. (MRA 87).

ACTION

BEOL REPAIR: RST 4009. Air Duct Assembly. To repair fretting at the internal diameters of the Seal Carriers by Plasma Spray.

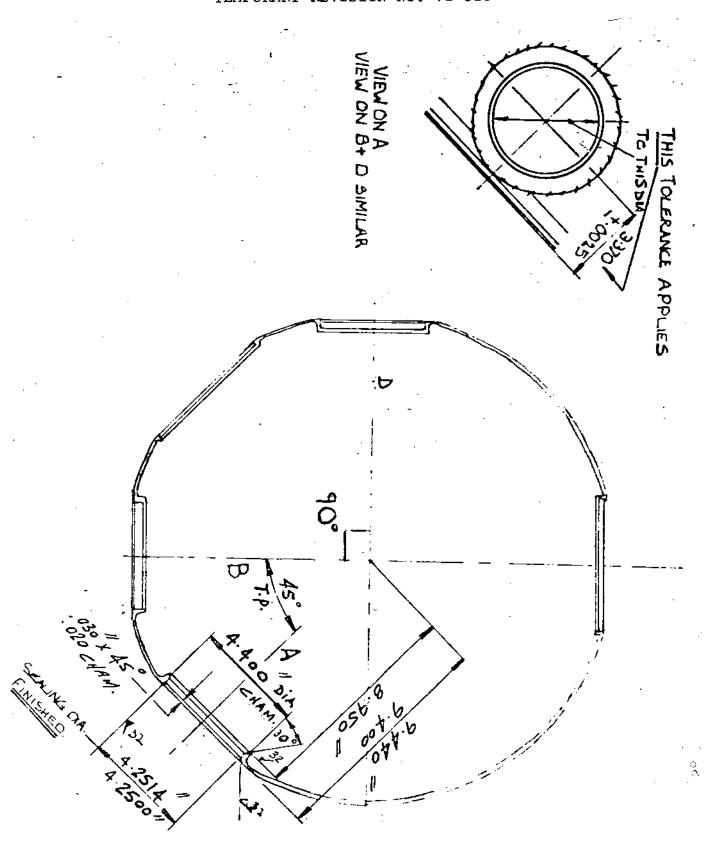
PROCEDURE



- 1. Set up and machine defective bore (A.B.D. Fig.2) to a diameter of 4.272 4.282 to clean up. Refer to Fig.1 and Fig.2.
- 2. Prepare the bore for spraying per TSD 594 Op. 704.
- 3. Apply a bond coat of Metco 450 MSRR 9507/5 to a thickness of 0.003 0.005 inches per TSD 594 Op. 704.
- 4. Apply the final coat of X40 MSRR 9507/3 to a thickness of 0.015 inches per TSD 594 Op. 704.
- 5. Machine to final diameter as per Fig. 2.
- 6. Inspect as per TSD 594 Op. 704.
- 7. Vibro engrave RST 4009 adjacent to P/No.

British airways CONCORDE

TEMPORARY REVISION No. 72-525



TR.72-525 72-51-01 TR Page 2 of 2 RST 4009

British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-543
Insert in 72-51-01 at rear of repair section in RST No. order
REASON FOR ISSUE:

To introduce a repair to No.13 Labyrinth cover unit by plasma spray rear outer locating diameter (MRA 119).

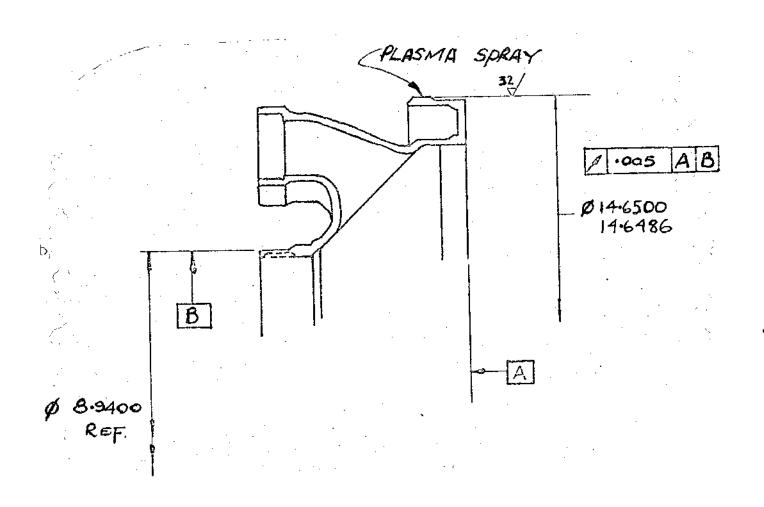
ACTION

RST 4027 cover unit Labyrinth No.13 - plasma spray rear outer locating dia.

- 1. Set up true on a suitable machine & grind existing coating to 14.6186 min. dia. Remove min. amount of base material.
- 2. Mask off areas not to be sprayed.
- 3. Plasma spray repair area using Metco 45C powder, as per T.S.D. 594-704.
- 4. Check for integrity of spray as per T.S.D. 594 Op. 704.
- 5. Grind to final dimensions using parameters shown.
- 6. Remove excess spray from other areas.
- 7. Dimensionally & visually inspect.
- 8. Vibro engrave RST 4027 adjacent to P/N.
- 9. The aforementioned is in accordance with OLY/Sedp/929.

British airways CONCORDE

TR.NO. 72-543 (cont'd)



TR.72-543 72-51-01 RST 4027 TR.Page 2 of 2



BLANKET ASSY OF, INSULATION FRONT AND REAR COVERS -

REPAIR OF DAMAGED BLANKETS BY PATCHING AND WELD REPAIR OF BRACKET(S)

REPAIR NO. B517833-4

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|--------------------|
| 72-51-01 | 4 /20B | B488293 B488321 |
| 72-51-01 | 5 /10B | B488297 B488322 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This instruction gives the procedure for repair of damaged blankets by patching and weld repair of bracket(s) on the Blanket Assy of, Insulation Front and Rear Covers.

Source demonstration is not necessary for this repair.

Blanket skin damage is to be repaired as follows:

Cracks and Fretting - apply patch.

Tears - remove damaged area, radius corners 0.250 (6,35) and apply patch.

Where defects occur within 1.000 (25,40) of each other, cover with a single patch to avoid adjacent patches. Where a number of defects to outer skin necessitates a path in excess of 2 sq.in. (2580,64 sq.mm), the skin must be removed before patching. Where defects occur which when patched will be adjacent to existing patch(es), remove existing patch(es) and skin so that, where possible, one patch will cover maximum amount of damage. Maximum length of any one side of patch 4.000 (101,60). Patch overlap to be a minimum of 0.500 (12,70) on existing skins.

REPAIR

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72-51-01 Repair No.13 Page 401 Care must be taken not to obstruct breather positions when patching.

Any cracked Bracket(s) are to be weld repaired.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Machine where marked
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

This Repair Instruction is covered in two parts:

PART A

B517833 covers the Blanket Assy-of, Insulation Front Cover.

PART B

8517834 covers the Blanket Assy-of, Insulation Rear Cover.

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

PART A - Blanket Assy-of, Insulation Front Cover.

- A. Examine the Part
- Do a visual inspection of the part to identify areas of damage and method of repair.

Refer to General Data. Refer to Fig. 401.

- B. Remove the Damage
- Remove the damage (if required).

Refer to General Data. Use hand held tools.

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- C. Clean the Part
- 1) Locally remove the grease.

Refer to TASK 70-00-00-100-101 or TASK 70-00-00-100-102. Use degreasing equipment.

- D. Patch Damage to Outer Skin
- 1) Replace any insulating filler material as necessary. Produce suitable patch(es) and seamweld and/or microspot weld in position as near as possible to their edges.

Refer generally to TASK 70-00-00-300-403 SUBTASK 70-00-00-860-403-053. Refer to General Data. Use a portable resistance welding kit. Refer to Para.6 DATA for insulating filler material, packing density and patch material. Refer to Fig. 401.

NOTE: Ensure that the dimples on the blanket and patch engage each other.

- E. Vee-groove Cracked Bracket(s)
- Vee-groove cracked area(s) of bracket(s) ready for welding. Ensure area(s) are thoroughly clean.

Use hand held tools.
Refer to TASK
70-00-00-300-409
SUBTASK
70-00-00-860-409-052.
Refer to Fig.401 and 402.

- F. Weld the Bracket(s)
- Apply the weld filler to the repair area(s).

Refer to TASK
70-00-00-300-409.
Use OMat 306 Welding
filler wire 18/8 chromium
nickel stainless steel.
Use argon arc welding
equipment Weld group 3.
Refer to Fig.401 and 402.

- G. press the Weld
- Dress weld flush with adjacent surfaces.

Use hand held tools. Refer to Fig. 401 and 402.

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H. Penetrant Crack Test

 Do a penetrant crack test on the repair area(s). Refer to TASK
70-00-00-200-213
SUBTASK
70-00-00-230-213-002.
Use OMat 653 Fluorescent
penetrant medium
sensitivity.
Cracks are not permitted.
Use penetrant crack test
equipment.

J. Examine the Part

 Do a visual inspection of the part. Refer to Fig. 401 and 402.

K. Identify the Repair

1) Mark on B517833 or R13A adjacent the part number.

Refer Overhaul Manual Chapter 72-09-00 Repair. Use vibration peen equipment. Refer to Fig.402.

PART B - Blanket Assy-of, Insulation Rear Cover.

L. <u>Examine the Part</u>

1) Do a visual inspection of the part to identify areas of damage and method of repair. Refer to General Data. Refer to Fig. 403.

M. Remove the Damage

 Remove the damage (if required). Refer to General Data.

N. Clean the Part

1) Locally remove the grease.

Refer to TASK 70-00-00-100-101 or TASK 70-00-00-100-102. Use degreasing equipment.

> 72-51-01 Repair No.13 Page 404 Jun 1/98



- O. Patch Damage to Outer Skin
- 1) Replace any insulating filler material as necessary. Produce suitable patch(es) and seamweld and/or microspot weld in position as near as possible to their edges.

Refer generally to TASK 70-00-00-300-403 SUBTASK 70-00-860-403-053. Use a portable resistance welding kit. Refer to General Data. Refer to Para.6 DATA for insulating filler material, packing density and patch material. Refer to Fig. 403.

NOTE: Ensure that the dimples on the blanket and patch engage each other.

- P. Vee-groove Cracked Bracket(s)
- Vee-groove cracked area(s) of bracket(s) ready for welding. Ensure area(s) are thoroughly clean.

Use hand held tools.
Refer to TASK
70-00-00-300-409
SUBTASK
70-00-00-860-409-052.
Refer to Fig.403 and 404.

- Q. Weld the Bracket(s)
- Apply the weld filler to the repair area(s).

Refer to TASK
70-00-00-300-409.
Use OMat 306 Welding
filler wire 18/8 chromium
nickel stainless steel.
Use argon arc welding
equipment Weld group 3.
Refer to Fig.403 and 404.

- R. <u>Dress the Weld</u>
- Dress weld flush with adjacent surfaces.

Use hand held tools. Refer to Fig.403 and 404.



S. Penetrant Crack Test

 Do a penetrant crack test on the repair area(s). Refer to TASK
70-00-00-200-213
SUBTASK
70-00-00-230-213-002.
Use OMat 653 Fluorescent
penetrant medium
sensitivity.
Cracks are not permitted.
Use penetrant crack test
equipment.

- T. Examine the Part
- Do a visual inspection of the part.

Refer to Fig. 403 and 404.

- U. Identify the Repair
- 1) Mark on B517834 or R13B adjacent the part number.

Refer Overhaul Manual Chapter 72-09-00 Repair. Use vibration peen equipment. Refer to Fig.404.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

BLANKET ASSY OF, INSULATION FRONT AND REAR COVERS EBM

MSRR6253

- 6. DATA
- A. Insulating Filler Material
- 1) H.B.S.5 ("Dalfratex" B2) insulation. Blanket thickness 0.500 (12,7).

Obtainable from:

Darchem Aero Ltd., Stillington Works, Stillington, Stockton-on-Tees, Cleveland, TS21 1LB.

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- B. Packing Density
- 1) 6 Lf/cu ft. (96.12 kg/cu metre)
- C. Patch Material
- 1) Corrugated (dimpled) foil skin MSRR6523 0.006 (0,1524) thick, of a compatible dimpled size.
- 7. <u>TOOLS</u>

TOOL NUMBER

<u>DESCRIPTION</u>

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

NONE.

9. STANDARD EQUIPMENT

Argon arc welding equipment
Degreasing equipment
Hand held tools
Penetrant crack test equipment
Portable resistance welding kit
Use hand held tools
Vibration peen equipment

10. CONSUMABLE MATERIAL

OMat 306 Welding filler wire, 18/8 chromium nickel stainless steel

OMat 653 Fluorescent penetrant Medium sensitivity

NOTE: To identify the consumable materials refer to the Overhaul Materials Manual (OMat).

Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

11. EXPENDABLE PARTS

None

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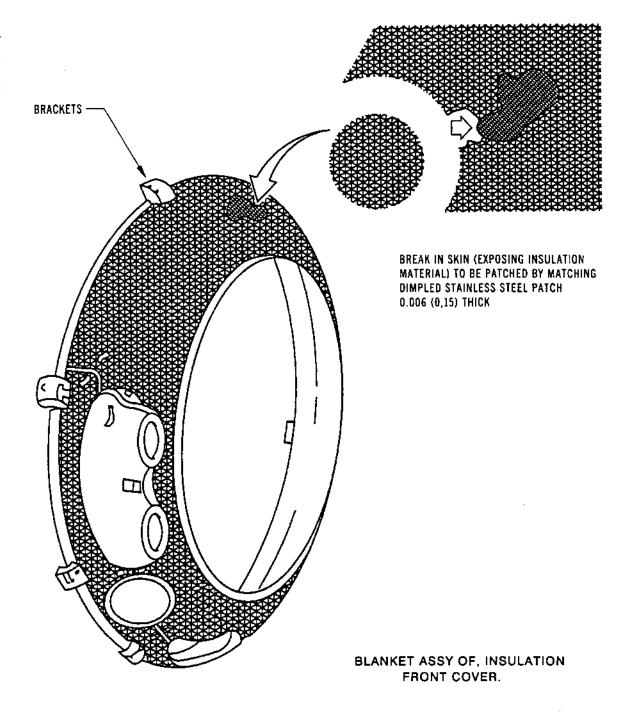
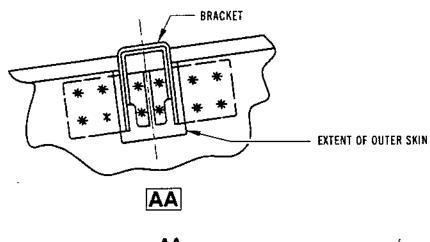


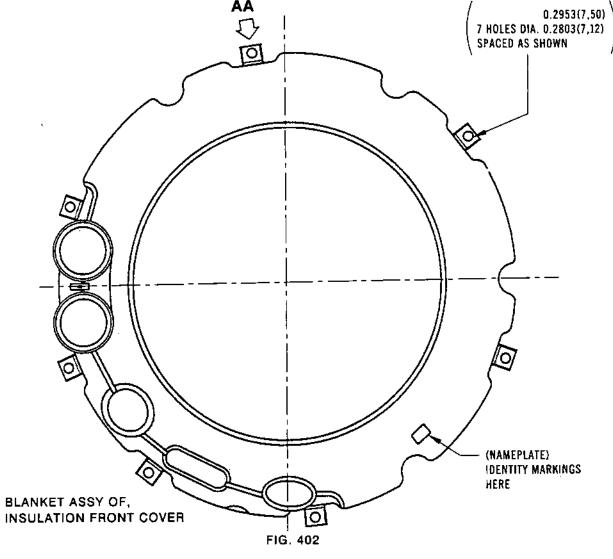
FIG.401

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BS60018349/1



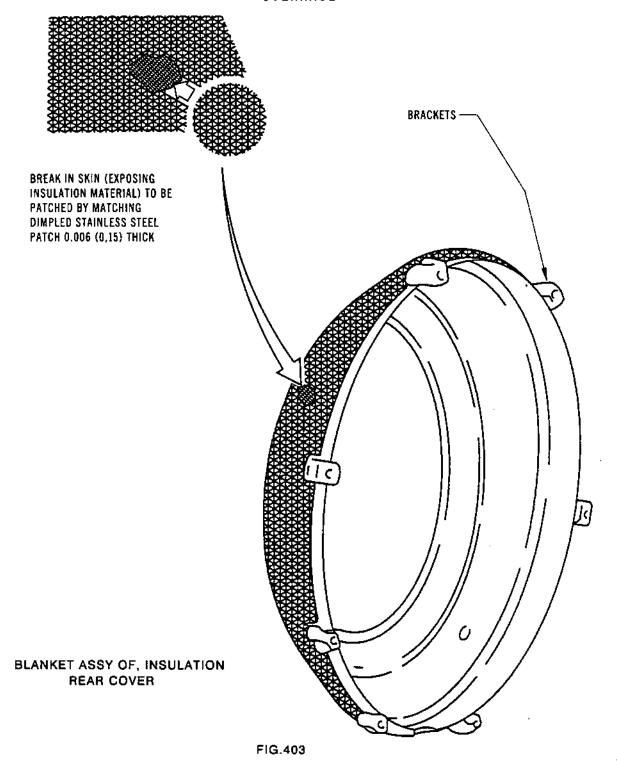




REPAIR

72-51-01 Repair No.13

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REPAIR
72-51-01
Repair No.13
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BS00018351/1

IDENTITY MARKINGS -

HERE



BRACKET 0.2953(7,50) 7 HOLES DIA 0.2803(7,12) SPACED AS SHOWN AB √ EXTENT OF OUTER SKIN AB BLANKET ASSY OF, **INSULATION REAR** COVER (NAMEPLATE)

Ó

FIG.404

REPAIR

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HP TURBINE NOZZLES - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|---------|------------|--|----------------|
| England | 1 | Labyrinth Housing Seal Lands Restored by Application of Abradable Coating | SAL.B.478071-4 |
| | 2 | Installation of Standard Replacement Vane Liners | SAL B.478014 |
| ri þ | 3 | To be issued | |
| Printed | 4 | Repair of Cracks and Previously Blended Trailing Edge Damage by Welding | SAL.B.497463 |
| | 5 | Provision for Removal and Replacing of Cooling Liner | SAL.B.497464 |
| | 6 | Cancelled | |
| | 7 | Cancelled | |
| | 8 | HP Turbine Nozzle Vane with Abrasion Resistant Coating in Outer Seal Surface | SAL.B.512623 |
| | 9 | HP Turbine Nozzle Vane - Restoration of Outer Seal Faces and Cracks by Brazing | SAL.8.512706-8 |
| | 10 | HP Turbine Nozzle Ring Assembly - Restoration of Fretting Retaining Slots by Welding | SAL.B.513474 |
| | ∙11 | Liner A/O - Replacement of Outer Liner | SAL.B.499447 |
| | 12 | Liner A/O - Replacement of Tube End | SAL.B.499448 |
| | 13 | Liner A/O - Replacement of Inner Liner and Tube End | SAL.B.499449 |

REPAIR 72-51-02 Contents 1 Jan 31/94

HP TURBINE NOZZLES - REPAIR LABYRINTH HOUSING SEAL LANDS RESTORED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Labyrinth Housings B.458451, B.925602

Authority:

Modification No. OL.7507C

1. Introduction

- A. This Repair describes the procedure for restoring labyrinth housing seal lands, in order to maintain the standard fin/housing clearances of labyrinth No.19, No.20, No.21 and No.22. The defective locations are first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus in Table 401 and on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. Any one seal location, or all four, may be restored at one repair.
- B. Verify that there is adequate material at each defective location to permit machining to the dimensions before spraying (Ref.para.3.B).

Summary of Operations

- A. Set the labyrinth housing true on datum diameter A and flange face B (Ref.Fig. 401).
- B. Machine defective locations to the specified dimensions (Ref.Table 401 and Fig. 402).
- C. Crack test the housing with fluorescent-penetrant.

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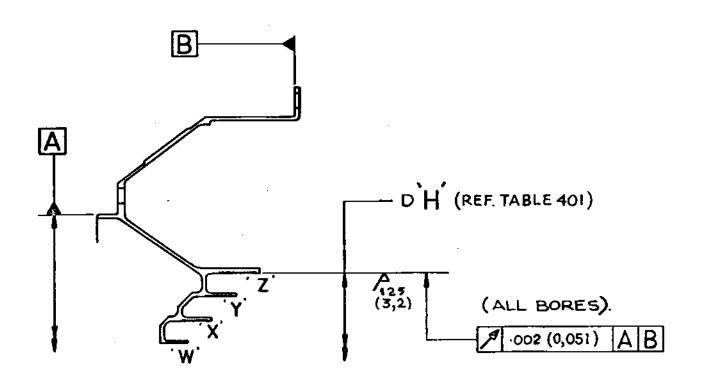
- D. Apply abradable coating (Ref.Fig.403).
 - (1) Combustion flame spray the seal lands with a bond coating of Metco 450, 0.003 in./0.004 in. (0,076 mm/0,102 mm) in thickness.
 - (2) Plasma spray Sherritt Gordon 75/25 Nickel/Graphite abradable coating 0.030 in. (0,762 mm) in thickness over the bond coating.
- E. Finish machine the the seal lands (Ref.Fig.401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Identify repair (Ref.Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the labyrinth housing.

| REPAIR SCHEME NO. | BORE LOCATION | DIAMETER 'F' (REF | DIMENSION 'G' .FIG.401 and 4 | DIAMETER 'H' |
|-------------------------|------------------|------------------------------------|------------------------------|------------------------------------|
| SAL B.478071 | W | 9.280(235,712) 9.277(235,636) | _ | 9.230(234,442) 9.228(234,391) |
| SAL B.478072 | X | 10.240(260,096) 10.237(260,020) | 0.550(13,970) | 10.190(258,826) 10.188(258,775) |
| SAL B.478073 | Y | 11.200(284,480) 11.197(284,404) | 0.600(15,246) | 11.150(283,210) 11.148(283,159) |
| SAL B.478074 | Z | 12.160(308,864) 12.157(308,788) | 0.700(17,780) | 12.110(307,594) 12.108(307,543) |

Before Spraying and Standard Dimensions
Table 401

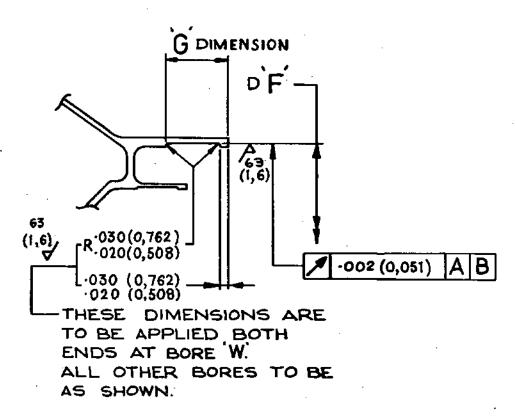
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Standard Dimensions Figure 401





Machining Dimensions Before Spraying Figure 402



Spraying Detail Figure 403

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HP TURBINE NOZZLES - REPAIR INSTALLATION OF STANDARD REPLACEMENT VANE LINERS MODIFICATION NO. 0L.8360C, 0L.8710C, 0L.8752C AND 0L.8812C

1. Effectivity

| I.P.C. Fig./Item | | <u>Part No.</u> | | | |
|------------------|-----|-----------------|-----------|-----------|--------------|
| 72-51-02 | | - | B.923592, | B.923593, | B.923594, |
| | | | B.923595, | B.927590, | B.927591, |
| | | | B.930570 | • | . |
| | 1 | 40B | B.927580, | B.927583, | B.929042, |
| | | | B.929043, | B.929044, | B.929045 |
| | 1 A | 40p | B.930568, | B.930569, | B.931328, |
| | | | | B.931330, | |
| | 1 | 50B | B.927581, | * | |
| | | 50D | B.930572, | | |
| | | 60B | B.927585, | | |
| | 1 4 | 60b | - | B-930577 | |

2. Introduction

- A. This Repair describes the procedure for removing defective liners from HP turbine nozzle vanes and the installation of standard replacement units.
- B. Refer to Chapter 72-09-00, Repair for all standard practices and tolerancing applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETRES).
- D. All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD.594-J).

3. Repair Limitations

A. Successive repairs may be applied by this procedure provided that all specified dimensions are maintained.

4. Summary of Operations

- A. Remove Defective Liner.
 - (1) Locate and secure the nozzle in the fixture (item 1) and set up on a vertical turnet lathe.
 - (2) Machine away the outer flange of the liner from the outer conical face; take care not to cut into the nozzle (Ref.Fig.402).

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- (3) Remove remnant of flange and braze material from the outer face of the nozzle.
- (4) Remove the liner by driving the tube end through the inner locating plate; use drift (item 2) and support block (item 3). Remove burrs from the outer wall.

NOTE: If difficulty is experienced in removing the liner, adopt the following procedure.

- (5) Relocate and secure the nozzle in the fixture (item 1) and set up on an internal grinder.
- (6) Grind away the inner locating plate and braze material from the inner conical face of the nozzle; remove burrs from the inner wall. Drive the liner from the nozzle with the tools quoted in para. (4).

CAUTION: TAKE CARE NOT TO REMOVE MORE THAN 0.005 IN.
(0.127 MM) FROM THE END FACES OF THE NOZZLE.

- (7) Inspect the nozzle for satisfactory removal of the liner.
- (8) Crack test the nozzle by the fluorescent penetrant process specified for this component in 72-51-02, Inspection/Check.
- B. Fit Replacement Liner (Ref.Fig. 403).
 - NOTE: The air holes (Ref.para.C) may be produced prior to or after brazing liner(s) in position. When working on vanes that have been modified to SB.OL.593-72-8456-169, produce holes as shown at Fig.404.
 - (1) Mask and prepare the nozzle as required and nickel strike the inner and outer conical faces of the nozzle.
 - (2) Degrease the vane nozzle and the new replacement liner (Ref. Para.6); ensure that pockets of solvent are not trapped in the components.

- (3) Fit and, if necessary, dress the replacement liner; the abutment faces of the nozzle and liner must be within 0.002 in. (0,051 mm).
- (4) Secure the liner to the vane by poke-welding at two positions on the outer platform or tack weld to TASK 70-00-00-300-409, SUBTASK 70-00-00-860-409-052. Use 0Mat 305. Tacks to be just sufficient in size to hold liner.
- (5) If the inner locating plate has been removed (Ref.para.A.(6)) assemble a new replacement plate to the nozzle and swage the tube end of the liner into the tapered hole in the plate. Use support block (item 3) and swage tool (item 4).
- (6) Ensure the surface around the tack weld is thoroughly cleaned prior to brazing to ensure good flow of braze. Refer to TASK 70-00-00-300-416, SUBTASK 70-00-00-310-416-003.
- (7) Stop-off as required and vacuum braze the new components at the locations specified; use filler to spec., BS1845 NI4.
- (8) Remove stop-off with a wire brush.
- (9) If tack welding is used, visually inspect braze at tack welded position to ensure an adequate flow of braze in that area.
- (10) Flame test to ensure freedom of movement of the liner.
 - (a) Set a dial indicator against end of liner (inner locating plate end).
 - (b) Evenly heat the vane containing the liner, by applying a flame from a Butane/Propane type hand blow lamp. Keep the nozzle of the blow lamp a minimum of 2 inches (50,8 mm) from the surface of the vane. Heat for a maximum of 5 min.



- (c) Liners not restricted in any way will show longitudinal expansion on dial indicator.
- (11) Repeat the test for cracks.
- C. Machine Air Holes in New Liner (Ref. Fig. 403 and 404).
 - NOTE: These holes may be produced prior to or after brazing liner(s) in position.
 - (1) Locate and secure the nozzle in the appropriate fixture (item 5 or 6) and set up on the electro discharge machine.
 - (2) Set up electrode holder (item 7) electrode straps (item 8) and electrodes (item 9) 0.045 in. (0,143 mm) in diameter on the electro discharge machine. Use the straps to set the electrodes to correspond with the pitch and alignment of the holes in the vane.

CAUTION: TAKE CARE IN OPERATION (3) NOT TO TOUCH THE OPPOSITE INSIDE SURFACE OF THE LINER WITH THE E.D.M. ELECTRODES.

- (3) Work through the existing holes in the vanes and produce the holes in the liners to the specified dimensions (Ref.Fig.403).
- (4) Remove the nozzle from the fixture and wash to remove any contamination from the E.D.M. process.
- (5) Inspect the nozzle to verify that the repair is satisfactory; repeat the test for cracks.
- D. Identify Repair.

Mark the repair scheme number SAL B.478014 close to the normal assembly number on the vane nozzle.

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MK.610-14-28 OVERHAUL snecma

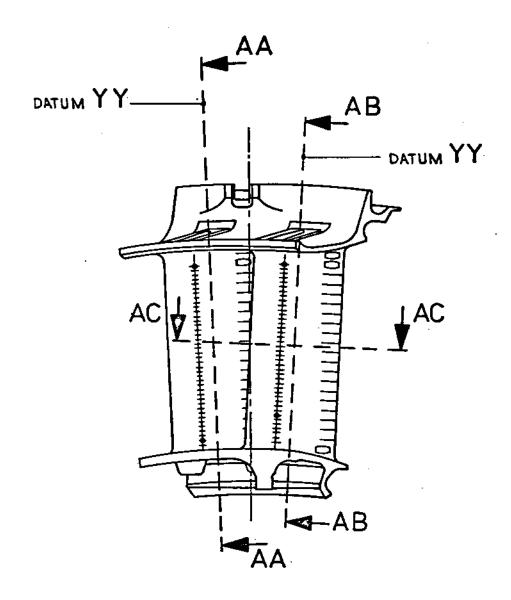
Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u>Item</u> |
|--------------------|----------|---------------|-------------|
| Fixture | 1 | S3S12640000 | 1 |
| Drift | 1 | \$3\$12786000 | 2 |
| Support Block | 1 | S3S12789000 | , 3 |
| Swage Tool | 1 | S3S12787000 | 4 |
| Fixture | 1 | S3S12791000 | 5 |
| Fixture | 1 | \$3\$12792000 | 6 |
| Electrode Holder | 1 | S3S12790000 | 7 |
| Electrode Strap | 2 | \$3\$12758000 | 8 |
| Electrodes | 40 | N/A | 9 |
| Replacement Parts | | | |
| | | A | Dont No |

6.

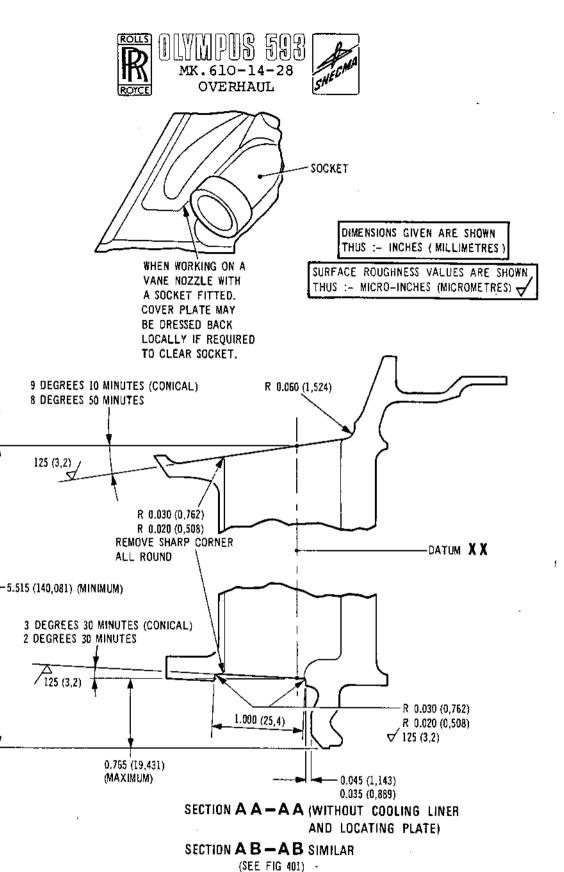
| <u>Description</u> | Quantity | <u>Part No.</u> |
|----------------------|--------------|----------------------------|
| Inner Locating Plate | 2 per nozzle | B.468816 |
| Cooling liner | 2 per nozzle | B.497471 or B.470428 |





Nozzle Section Data Figure 401

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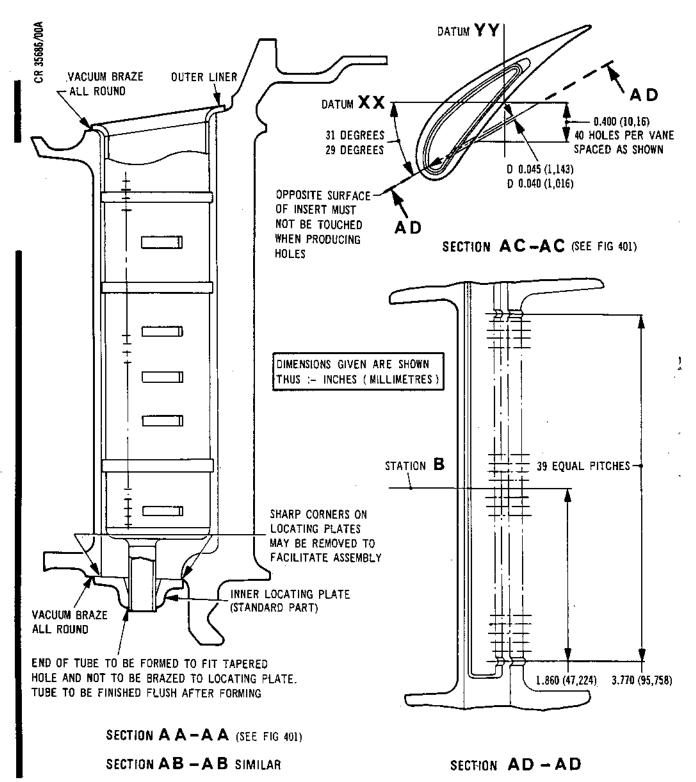
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Nozzle Machining Details Figure 402

72-51-02

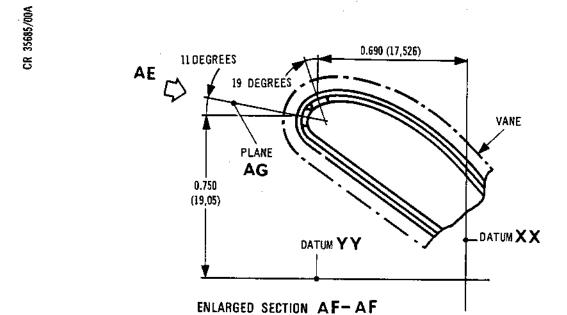
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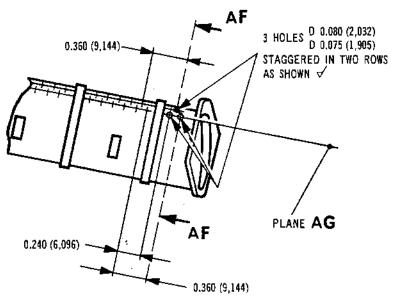




Nozzle/Liner Assembly Details Figure 403

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VIEW ON ARROW AE VANE OMITTED FOR CLARITY

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Hole Drilling Details Figure 404

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HP TURBINE NOZZLE VANE - REPAIR OF CRACKS AND PREVIOUSLY BLENDED TRAILING EDGE DAMAGE BY WELDING

MODIFICATION NO. OL.8710C AND 8778C

1. Effectivity

| I.P.C. | Fig./ | <u>Item</u> | <u>Part</u> | No. | |
|----------|---|-------------|-------------|-----------|-----------|
| 72-51-02 | 1 | 40B | | в.927583, | |
| | | | B.929043, | B.929044, | B.929045 |
| | 1 A | 40C | B.927559 | | |
| | 1 A | 40D | B.930564, | B.930567, | B.930568, |
| | | | B.930569, | B.931328, | B.931329, |
| | | | в.931330, | B.931331 | |
| • | 1 | 50B | в.927581, | | |
| | | | B.927561 | | |
| | | 50b | | B.930571, | B.930572. |
| | • | 302 | B.930573 | | |
| | 1 | 60B | B.927585, | B.927588 | |
| | | | B.927563 | | |
| | | | B.930566, | | B 030576 |
| | IA | 000 | B.930507 | 0.7303137 | 0.7505107 |

Introduction

A. General.

- (1) This repair describes the procedure for the welding of cracks that have occurred in the nozzle vane.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.



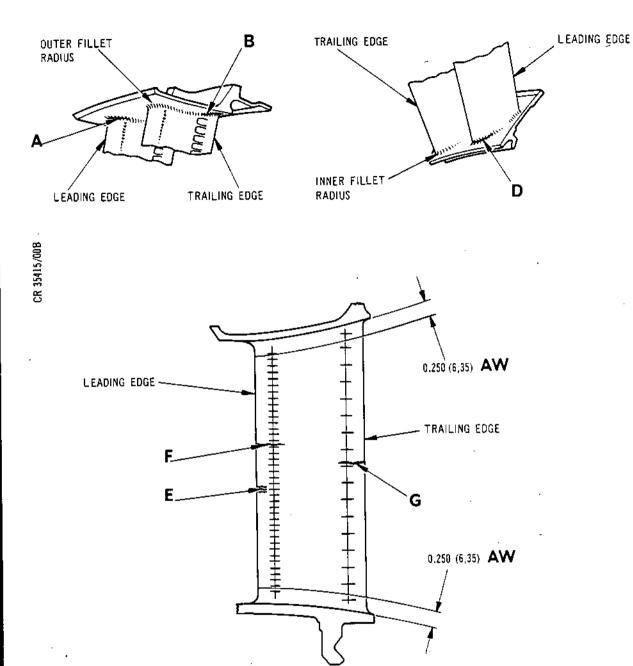
CR 35414/00B

| REPAIR LIMITATIONS (APPLICABLE TO BOTH VANES) | | | | | |
|---|-------------------------------|--|--|--|--|
| CRACK LOCATION | MAXIMUM LENGTH OF CRACK | MINIMUM DISTANCE TO NEAREST CRACK | MAXIMUM No OF CRACKS PER VANE | | |
| A OUTER FILLET RADIUS LEADING EDGE. MAY EXTEND INTO OUTER PLATFORM | 1.500 (38,10) | 0.750 (19,05) | 1 | | |
| B OUTER FILLET RADIUS TRAILING EDGE. MAY EXTEND INTO OUTER PLATFORM | 2,000 (50,80) | 0,750 (19,05) | 1 | | |
| D INNER FILLET RADIUS TRAILING EDGE. MAY EXTEND INTO INNER PLATFORM | 1.500 (38,10) | 0.750 (19,05) | 1 | | |
| E LEADING EDGE IN CLOSE PROXIMITY. EXCEPT WITHIN AW | 0.750 (19,05) | | _ | | |
| F LEADING EDGE. EXCEPT WITHIN AW | 1.00 (25,40) | 0.500 (12,70) | 4 | | |
| G TRAILING EDGE, EXCEPT WITHIN AW | 1.00 (25,40) | 0.500 (12,70) | 4 | | |

DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Repair Limitations Figure 401

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DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Repair Limitations Figure 402

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- (6) Place the nozzle vane in a suitable protective container during transit between operations to avoid damage.
- (7) The length of a leading edge (L.E.) crack is measured completely around the edge, (i.e. concave to convex. side), (Ref.Fig.403).
- (8) The length of a trailing edge (T.E.) crack is measured from the edge only, (Ref. Fig. 403).
- B. Repair Limitations.
 - (1) Repair limitations are contained in Figs. 401 and 402.

3. <u>Instructions</u>

- A. Prepare for Welding.
 - (1) Remove the air cooling liner(s) to the appropriate repair; refer to Table 401.

| NOZZLE VANE PART NO. | SALVAGE NO. | NOZZLE VANE PART NO. | SALVAGE NO. |
|--|-------------|---|---------------------------|
| B.927559) B.927561) B.927563) B.930564) B.930565) B.930567) B.930567) B.930571) B.930575) | | B.927580) B.927581) B.927583) B.927584) B.927585) B.927588) B.927588) B.929042) B.929043) B.929044) B.929045) B.930568) B.930569) B.930572) B.930573) B.930576) B.930577) B.931328) B.931330) B.931331) | B.478014 (Repair No.2) |

Removal and Replacement of Cooling Liner Table 401

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MK.610-14-28 snecma

- (2) Blank off all holes to ensure no ingress of stripping solution. Remove the pack aluminised surface coating; refer to Chapter 72-09-05 Repair, for relevant procedure. Any ingress of stripping solution <u>must</u> be removed.
- (3) Test the nozzle vane for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-02 Inspection/Check.
- (4) Notch crack(s) for welding (including previously blended trailing edge damage that is now beyond Repair No.9) using simple carbide burr, Ref.Fig.403 for preparation details of cracks in leading/trailing edges and cracks extending into the inner and outer platforms.
- B. Heat-treat and Weld Cracks.
 - (1) Heat treat as detailed in Chapter 72-09-28, Repair.
 - (2) Test the nozzle vane for cracks, using the flourescent dye penetrant process specified for this component in Chapter 72-52-07 Inspection/Check.
 - (3) Re-notch cracks if necessary.
 - (4) Weld cracks as detailed in Chapter 72-09-28, Repair, using welding chill ref. tool item 1.
 - (5) Finish the welds flush with the existing contours. A variation of 0.003 in. (0,076 mm) maximum on the vane aerofoil above the basic shape is acceptable. All other surfaces including slots and/or cut-away for the intrascope when applicable, (Ref.Figs.404, 405 and 406), are to be finished flush with existing surfaces. Hand grinding is permissible for dressing. Slot size may be produced by electrodischarge machining. Surface texture to be 125 micro-inches (3,2 micro-metres).

C. Inspect.

- (1) Test the nozzle vane for cracks using the fluorescent dye penetrant process, specified in this component in Chapter 72-51-02 Inspection/Check.
- (2) Carry out a non-destructive radiological (X-Ray) examination of the welded areas.

REPAIR

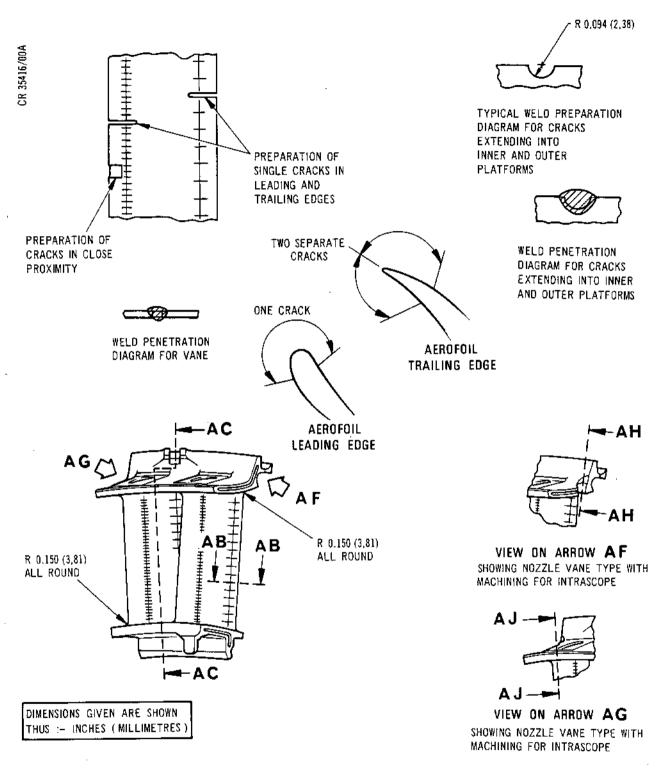
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Preparation of Cracks for Welding Figure 403

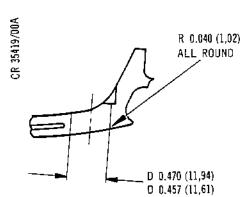
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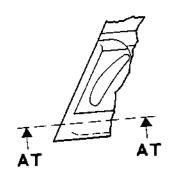
- p. Re-Notch and Heat Treat.
 - (1) Re-notch and heat treat if necessary, as detailed in Chapter 72-09-28, Repair.
- E. Inspect.
 - (1) General.
 - (a) Inspect the nozzle for cracks using the procedure and acceptance limits given in the following paragraph (2). If the nozzle meets the requirements of this inspection, proceed with the radio-logical examination and apply the added acceptance limits in accordance with paragraph (3).
 - (2) Inspect the nozzle by the fluorescent dye penetrant crack detection method using the process specified for this component in 72-51-02, Inspection/Check. Apply the following acceptance limits.
 - (a) Aerofoil (within permitted repair area at leading and trailing edges).
 - (i) Surface cracks are acceptable and may be blended out to a maximum depth of 0.015 in. (0.38 mm).
 - (ii) Two cracks up to 0.120 in. (3,05 mm) long are acceptable provided that they are at least 0.200 in. (5,1 mm) apart.
 - (iii) Five cracks up to 0.050 in. (1,30 mm) long are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.
 - (b) Fillet radii (within permitted repair area at leading and trailing edges).
 - (i) Cracks up to 0.080 in. (2,03 mm) are acceptable provided that they do not extend through the section or to within 0.320 in. (8,13 mm) of the leading or trailing edge.

0,170 (4,32)

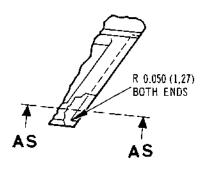
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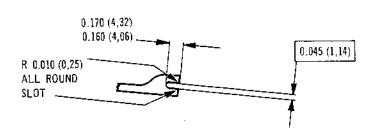
SECTION AH-AH
SECTION AJ-AJ



VIEW ON ARROW AN



VIEW ON ARROW AP



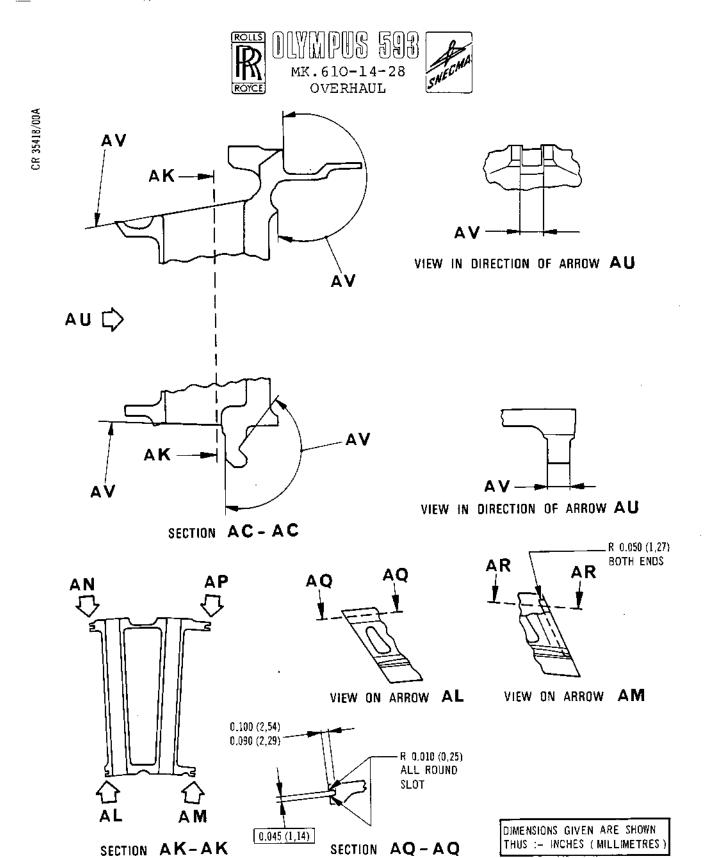
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SECTION AS -AS
SECTION AT - AT SIMILAR

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Weld Finishing Details Figure 404 REPAIR

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Weld Finishing Details Figure 405

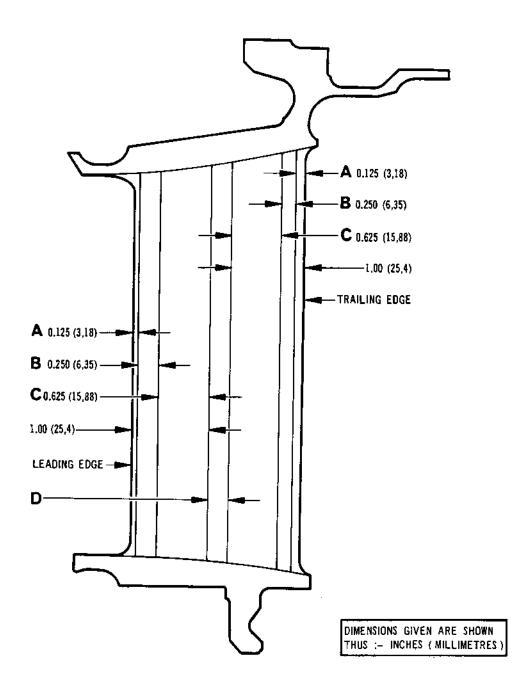
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- (c) Inner and outer platforms (within permitted repair area).
 - (i) Two cracks up to 0.120 in. (3,05 mm) long are acceptable in each platform provided that they are at least 0.200 in. (5,10 mm) apart.
 - (ii) Five cracks up to 0.050 in. (1,30 mm) long are acceptable in each platform provided that they are at least 0.100 in. (2,50 mm) apart.
 - (iii) Two cracks up to 0.100 in. (2,5 mm) long which extend into the core by not more than the platform thickness are acceptable in each platform.
- (d) Mid vane fillet radii (Ref.Fig.406, area D).
 - (i) Fillet radii cracks may be blended out to a maximum depth of 0.015 in. (0,38 mm).
- (3) Inspect the nozzle by radiological (X-Ray) examination in accordance with the requirements of M.T.109 CAT.X. Apply the following acceptance limits in conjunction with Figure 406.
 - (a) Area A.
 - (i) No cracks are acceptable.
 - (b) Area B.
 - (i) Cracks up to 0.050 in. (1,30 mm) long are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.

NOTE: Any crack which extends from area B to area C or vice versa, is subject to the acceptance limits for area B.

CR 35871/00A



Radiological Examination (X-Ray) Details
Figure 406

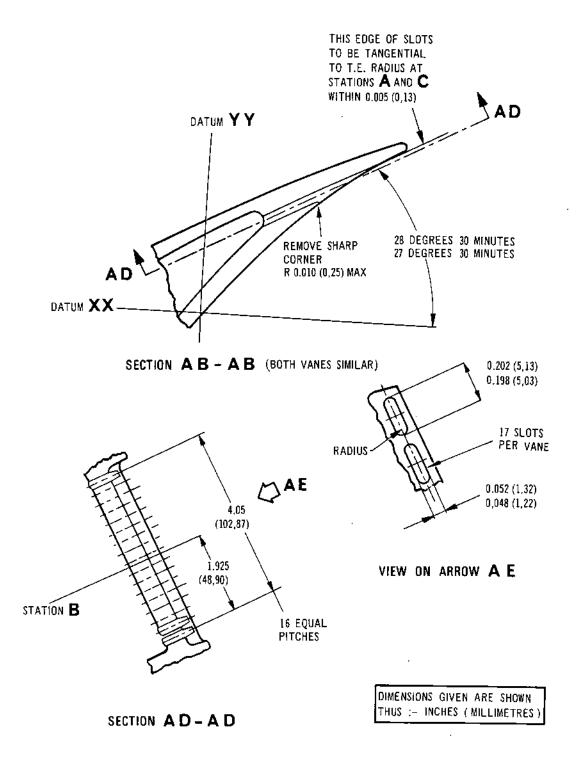
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- (c) Area C.
 - (i) One crack up to 0.250 in. (6,40 mm) long is acceptable.
 - (ii) Six cracks up to 0.100 in. (2,50 mm) long are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.
- (d) Area D.
 - (i) Isolated surface blow holes up to 0.100 in.(2,54 mm) diameter are acceptable.
 - (ii) Defects up to 0.020 in. (0,51 mm) diameter are acceptable.
- (e) General.
 - (i) Tungsten inclusions and cavities up to 0.125 in. (3,18 mm) diameter are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.
 - (ii) Up to 15% loss of section in repair areas is acceptable.
- (4) Visually inspect the vane nozzle to ensure acceptability of the brazing.
- F. Restore Cooling Slots.
 - (1) Restore trailing edge cooling slots as required Ref. Fig. 407. The electro-discharge machining process is permissible.
 - (2) Test the nozzle vane for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-02 Inspection/Check.

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Restoration of Cooling Slot Details Figure 407

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- G. Pack Aluminise.
 - (1) Pack aluminise the nozzle vane all over, except within AV or where marked AV, as shown in Fig. 405. Refer to Chapter 72-09-05 Repair for the relevant procedure.

NOTE: Pack aluminising thickness to be 0.001 to 0.002 in. (0.025 to 0.051 mm).

- H. Post Pack Aluminise Heat-treatment.
 - (1) Diffusion heat-treat the nozzle vane at a temperature of 900°C plus/minus 10°C and soak at this temperature for 4 hours, then air cool.
- J. Assemble the Nozzle Vane.
 - (1) Replace the air cooling liner(s) to the appropriate salvage number, Ref. Table 401. If excess weld penetration prevents the fitting of liner(s) it may be removed by electro-discharge machining.
- K. Identify.
 - (1) Mark salvage B.497463 or R4, close to the existing part number, using the electro-chemical marking technique as specified in Chapter 72-09-00 Repair.
- L. Finally Inspect.
 - (1) Finally inspect the nozzle vane assembly to ensure the repair has been carried out satisfactorily and the nozzle vane assembly is in a serviceable condition.
 - (2) Generally clean the nozzle vane assembly to remove grease and foreign bodies, then place the assembly in a protective container and store as required.
- 4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | Tool No. | Item | |
|--------------------|-----------------|--------------|------|--|
| Welding Chill | 1 | 838.13615000 | 1 | |



HP TURBINE NOZZLE VANE - REPAIR PROVISION FOR REMOVAL AND REPLACEMENT OF COOLING LINER MODIFICATION NO. OL.8710C AND OL.8752C

1. Effectivity

| <u>I.P.C.</u> | Fig./ | <u>Item</u> | | Part No. |
|---------------|-------|-------------|-----------|----------|
| 72-51-02 | 1 A | 40C | в.927559 | |
| | | 40 D | B.930564, | B.930567 |
| | | 50C | 8.927561 | |
| | | 50 D | B.930565, | B.930571 |
| | | 60C | B.927563 | |
| | | 600 | B.930566, | B.930575 |

Introduction

A. General.

- (1) This repair describes the procedure for removing defective liners from HP turbine nozzle vanes and the installation of standard replacement units.
- (2) Refer to Chapter 72-09-00, Repair for all standard practices applicable to this repair procedure.
- (3) Dimensions are shown thus; INCHES (MILLIMETRES), in tables and illustrations.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro inches (3,2 micro meters) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.



- (10) All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD.594-J).
- B. Repair Limitations.
 - (1) Successive repairs may be applied by this procedure provided that all specified dimensions are maintained.

3. Instructions

- A. Remove Defective Liner.
 - (1) Locate and secure the nozzle in fixture ref. tool item 1 and set up on a vertical turret lathe.
 - (2) Machine away the outer flange of the liner from the outer conical face; take care not to cut into the nozzle (Ref.Fig.402).
 - (3) Remove remnant of flange and braze material from the outer face of the nozzle.
 - (4) Remove the liner by driving the tube end through the inner locating plate; use drift ref. tool item 2 and support block ref. tool item 3. Remove burrs from the outer wall.
 - NOTE: If difficulty is experienced in removing the liner, adopt the following procedure.
 - (5) Relocate and secure the nozzle in fixture ref. tool item 1 and set up on an internal grinder.
 - (6) Grind away the inner locating plate and braze material from the inner conical face of the nozzle; remove burrs from the inner wall. Drive the liner from the nozzle with the tools ref. items 2 and 3.
 - CAUTION: TAKE CARE NOT TO REMOVE MORE THAN 0.005 IN.
 (0.127 MM) FROM THE END FACES OF THE NOZZLE.
 - (7) Inspect the nozzle for satisfactory removal of the liner.
 - (8) Crack test the nozzle by the fluorescent dye penetrant process specified for this component in 72-51-02, Inspection/Check.

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- B. Fit Replacement Liner (Ref.Fig.403).
 - NOTE: The air holes (Ref.para.C.) may be produced prior to or after brazing liner(s) in position. When working on vanes that have been modified to SB.OL.593-82-8456-169, produce holes as shown at Fig.404.
 - (1) Mask and prepare the nozzle as required and nickel strike the inner and outer conical faces of the nozzle.
 - (2) Pegrease the vane nozzle and the new replacement liner (Ref. Para.5); ensure that pockets of solvent are not trapped in the components.
 - (3) Fit and, if necessary, dress the replacement liner; the abutment faces of the nozzle and liner must be within 0.002 in. (0,051 mm).
 - (4) Secure the liner to the vane by poke-welding at two positions on the outer platform or tack weld to TASK 70-00-00-300-409, SUBTASK 70-00-00-860-409-052. Use OMat 305. Tack to be just sufficient in size to hold liner.
 - (5) If the inner locating plate has been removed (Ref.para.A.(6)) assemble a new replacement plate to the nozzle and swage the tube end of the liner into the tapered hole in the plate. Use support block ref. tool item 3 and swage tool ref. tool item 4.
 - (6) Ensure the surface around the tack weld is thoroughly cleaned prior to brazing to ensure good flow of braze. Refer to TASK 70-00-00-300-416, SUBTASK 70-00-00+310-416-003.
 - (7) Stop-off as required and vacuum braze the new components at the locations specified; use filler to spec., BS1845 NI4.
 - (8) Remove stop-off with a wire brush.

- (9) If tack welding is used to secure liner, visually inspect braze at tack welded position to ensure an adequate flow of braze in that area.
- (10) Flame test to ensure freedom of movement of the liner in the locating plate.
 - (a) Set a dial indicator against end of liner (inner locating plate end).
 - (b) Evenly heat the vane containing the liner, by applying a flame from a Butane/Propane type hand blow lamp. Keep the nozzle of the blow lamp a minimum of 2 inches (50,8 mm) from the surface of the vane. Heat for a maximum of 5 min.
 - (c) Liners not restricted in any way will show longitudinal expansion on dial indicator.
- (11) Crack test the nozzle by the fluorescent dye penetrant process specified for this component in 72-51-02, Inspection/Check.
- C. Machine Air Holes in New Liner.
 - (1) Locate and secure the nozzle in the appropriate fixture ref. tool item 5 or 6 and set up on an electro discharge machine.
 - (2) Set up electrode holder ref. tool item 7 electrode straps ref. tool item 8 and electrodes ref. tool item 9, 0.045 in. (0,143 mm) diameter. Use the straps to set the electrodes to correspond with the pitch and alignment of the holes in the vane.

CAUTION: TAKE CARE IN OPERATION (3) NOT TO TOUCH THE OPPOSITE INSIDE SURFACE OF THE LINER WITH THE E.D.M. ELECTRODES.

(3) Work through the existing holes in the vanes and produce the holes in the liners to the specified dimensions (Ref.Fig.403).

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- (4) Remove the nozzle from the fixture and wash to remove any contamination from the E.D.M. process.
- D. Finally Inspect.
 - (1) Crack test the nozzle by the fluorescent dye penetrant process specified for this component in 72-51-02, Inspection/Check.
 - (2) Finally inspect the nozzle to ensure the repair has been carried out satisfactorily and the nozzle is in a serviceable condition.
 - (3) Generally clean the nozzle to remove grease and foreign bodies, then place in a protective container and store as required.
- E. Identify.

Mark the repair scheme number SAL B.497464 or R5 close to the normal assembly number on the vane nozzle, using the electro-chemical marking technique as specified in 72-09-00, Repair.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u> Item</u> |
|--------------------|----------|---------------|--------------|
| Fixture | 1 | \$3\$12640000 | 1 |
| Drift | 1 | S3S12786000 | 2 |
| Support Block | 1 | \$3\$12789000 | 3 |
| Swage Tool | 1 | S3S12787000 | 4 |
| Fixture | 1 | S3S12791000 | 5 |
| Fixture | 1 | \$3\$12792000 | 6 |
| Electrode Holder | 1 | \$3\$12790000 | 7 |
| Electrode Strap | 2 | S3S12758000 | 8 |
| Electrodes | 40 | N/A | 9 |

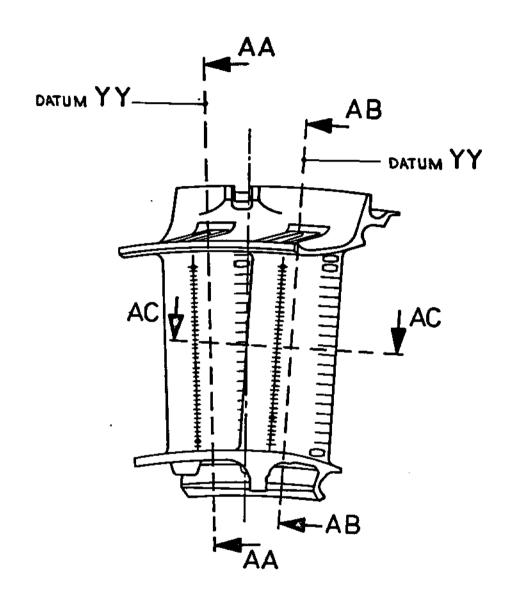
5. Replacement Parts

| <u>Description</u> | Quantity | <u>Part No.</u> |
|----------------------|--------------|-----------------|
| Inner Locating Plate | 2 per nozzle | B.468816 |
| Cooling liner | 2 per nozzle | B.497472 |

REPAIR



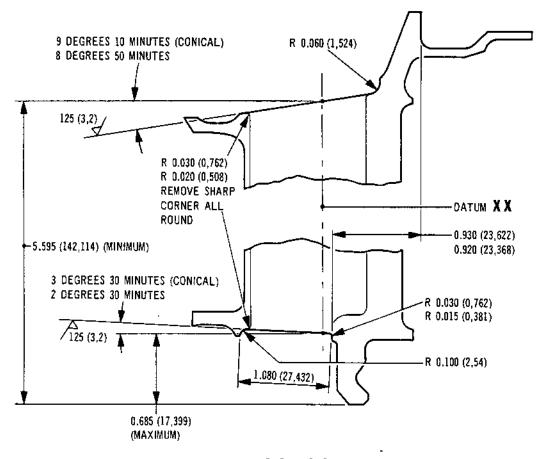
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Nozzle Section Data Figure 401

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SECTION A A - A A (WITHOUT COOLING LINER AND LOCATING PLATE)

SECTION AB - AB SIMILAR

(SEE FIG 401)

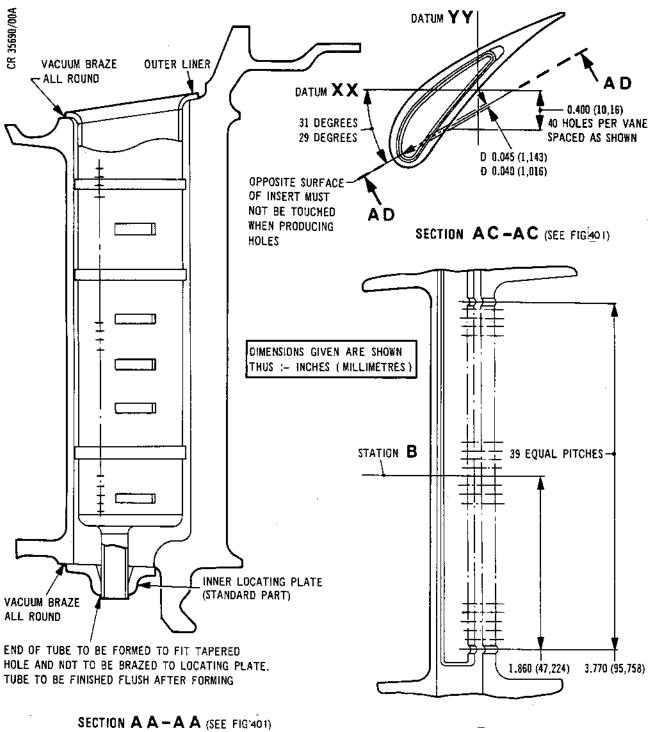
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Nozzle Machining Details Figure 402

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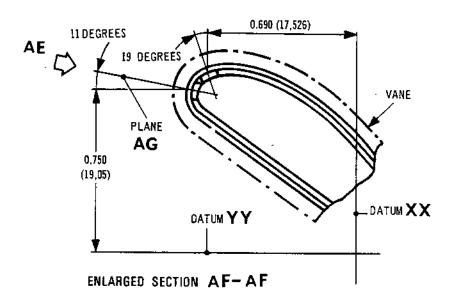
SECTION AB - AB SIMILAR

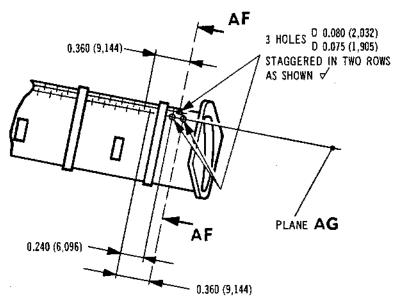
SECTION AD - AD

Nozzle/Liner Assembly Details Figure 403

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CR 35685/00A





VIEW ON ARROW AE VANE OMITTED FOR CLARITY

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Hole Drilling Details Figure 404

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HP TURBINE NOZZLE VANE - REPAIR RESTORATION OF REAR OUTER SEAL SURFACE WITH ABRASION RESISTANT COATING

MODIFICATION NO. OL.8941C

1. Effectivity

| I.P.C. | <u>Fig.</u> | <u>/Item</u> | <u>Part</u> | No. | |
|----------|-------------|--------------|-------------|-----------|-----------|
| 72-51-02 | 1 | 40B | | B.927583, | |
| | | | B.929043, | B.929044, | B.929045 |
| | 1 A | 40C | в.927559 | | |
| | 1 A | 40D | B.930564, | B.930567, | B.930568, |
| | | | B.930569, | B.931328, | B.931329, |
| | | | B.931330, | | |
| | 1 | 50B | B.927581, | | |
| | 1 A | 50C | B.927561 | | |
| | 1 A | 50D | B.930565, | B.930571, | B.930572, |
| | | | B.930573 | _ | • |
| | 1 | 60B | B.927585, | B.927588 | |
| | 1 A | 60C | B.927563 | | |
| | 1 A | 600 | B.930566, | B.930575, | B.930576, |
| | | | B.930577 | • | - |

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the rear outer seal surface by plasma spray coating with an abrasion resistant coating (LCO22).
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Place the nozzle vane in a suitable protective container during transit between operations to avoid damage.

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REPAIR



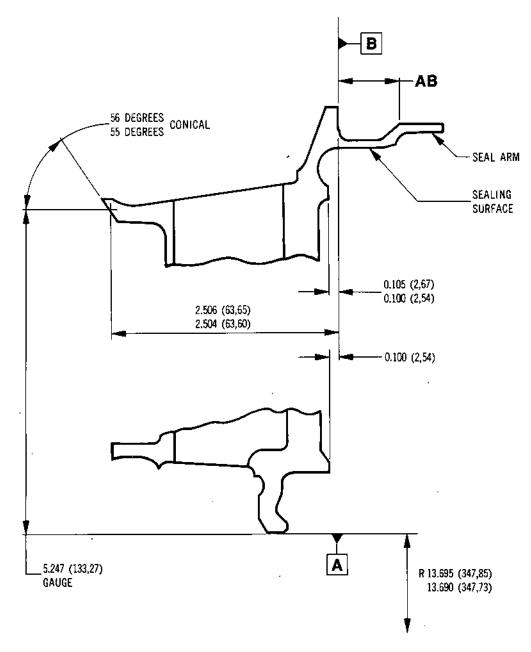
B. Repair Limitations.

- (1) Vane assemblies identified as having the outer rear sealing surface previously restored by braze build~up and carrying repair number B512707 or R9B may not be repaired in accordance with this repair. Refer to Repair Scheme No.SAL.B512707.
- (2) Vane assemblies may be restored using this repair process, provided that corrosion or sulphidation damage on area AB (Ref. Fig. 401) does not exceed the following limits:
 - (a) Pits up to 0.020 in. (0,51 mm) diameter in any number or spacing.
 - (b) Pits between 0.020 in. (0,51 mm) and 0.040 in. (1,02 mm) diameter not forming a continuous chain or concentrated pattern.
 - (c) Sulphidation blisters or eruptions up to 0.040 in. (1,02 mm) diameter not forming a continuous chain, concentrated pattern or cluster in a ridge or line over 0.080 in. (2,04 mm) in length.
- (3) Cracks are not acceptable.
- (4) The minimum wall section at the sealing surface (Ref. Figs.401 and 402) is 0.055 in. (1,40 mm) before repair.

3. Instructions

- A. Preparation.
 - (1) If an abrasion resistant coating LCO22 has previously been applied as instructed in this repair (identified by SALB512623 MC or RST 4097/1 marking), remove the coating as instructed in paragraph 6.
 - (2) If there is no existing LCO22 coating, machine the sealing surface (Ref. Fig. 401) within the repair limits, removing the minimum material to ensure that the full face is cleaned up (Ref. Fig. 402).
- B. Remove Pack Aluminising.
 - (1) Mask off inner and outer cooling liner brazed joints.
 Blank off all cooling holes and internal passageways
 to ensure no ingress of stripping solution.

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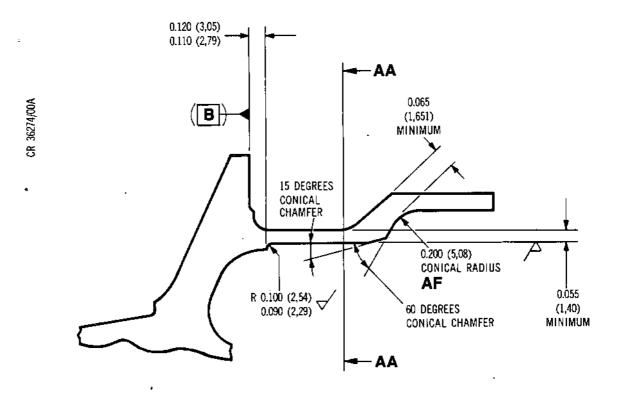


TYPICAL SECTION THROUGH VANE

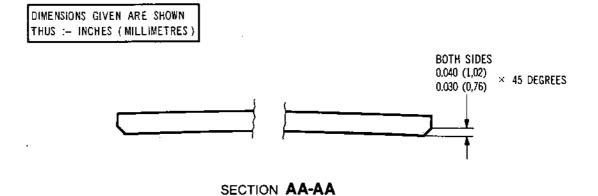
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

> HP Turbine Nozzle Vane Figure 401





VIEW ON SEAL ARM (REF FIG 401)



Machining Details Figure 402

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(2) Strip the pack aluminising as instructed in Chapter 72-09-05 Repair.

C. Machine.

- (1) Machine up to 0.005 in. (0,13 mm) from radius AF (Ref. Fig.402) to remove oxidation and suphidation. If the seal arm is distorted and machining fails to remove corrosion, use the chemical strip process detailed in paragraph 7.
- (2) Chamfer the side edges of the seal arm over length AD in Figure 403, to the dimensions in Figure 402, section AA. Use conventional hand tools.

D. Etch.

(1) Locally swab-etch the sealing surface, side edges, radius AF and area AB (Ref. Figs. 401 to 403), as instructed in Chapter 72-09-14 Repair, using Solution E. Maximum contact time is 2 minutes.

E. Inspect.

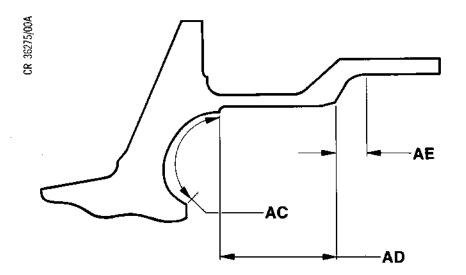
- (1) Visually inspect for traces of sulphidation on areas AB, AD and AE (Ref. Figs. 401 and 403) as follows:
 - (a) Sulphidation will normally appear as a black deposit.
 - (b) After etching, machined surfaces should be an even light matt grey colour with grain structure visible on areas to be coated.
 - (c) After chemical stripping, difficulty may be experienced in revealing the grain structure. This is acceptable provided the surface is an even light matt grey colour.

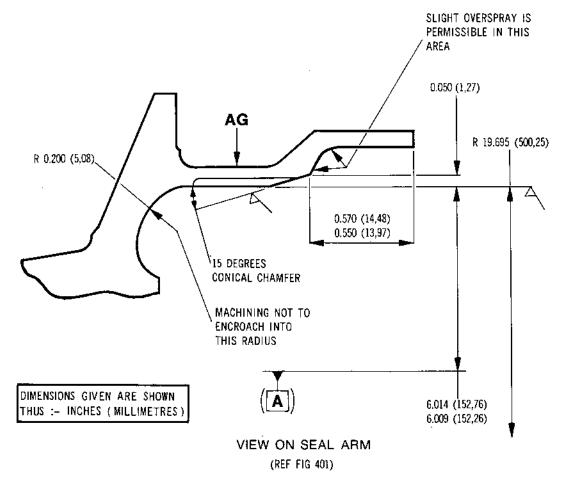
F. Remove sulphidation.

- (1) If sulphidation is present at the sealing surface, (Ref. Fig. 401) remove it by machining off the minimum material within the repair limits (Ref. Fig. 402).
- (2) If sulphidation is present on areas AB or AF, remove it, using the chemical strip process detailed in paragraph 7.

REPAIR







Finish Machining Details Figure 403

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G. Inspect.

- (1) Inspect the seal arm for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-02 Inspection/Check.
- (2) Visually inspect areas AD and AE (Ref. Fig. 403). The surface should appear an even matt grey with no signs of discolouration or sponginess.

H. Plasma Spray.

(1) Mask off all areas except AD.

CAUTION: ENSURE THAT VANE AEROFOIL TUBES AND COOLING HOLES ARE BLANKED OFF.

Slight overspray is permitted on area AE (Ref. Fig. 403).

(2) Plasma spray area AD with LCO22 (MSRR 9537/1) as instructed in Chapter 72-09-11 Repair, ensuring that adequate coating is applied to allow for machining.

Interstage anneal coating at 1080 deg. C plus/minus 10 deg. C for 4 hours in a vacuum after the initial 0.009 in. (0,23 mm) thickness and for each interval of 0.020 in. (0,51 mm) thereafter.

J. Machine.

- (1) Machine the seal arm to the dimensions given in Figures 401 and 403.
- (2) Hand dress or machine to restore side faces (Ref. Fig. 404).

K. Clean.

(1) Locally clean the reworked areas using a group 1 solvent (Ref.72-09-00 - Cleaning) and a nylon bristle brush.

L. Inspect.

(1) Inspect the reworked areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-02 Inspection/Check.

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M. Pack Aluminise.

- (1) Pack aluminise the vane assembly all over except where marked AH on Figure 405, as detailed in Chapter 72-09-05 Repair. Pack aluminising thickness to be 0.002/0.001 in. (0,05/0,03 mm).
- (2) Diffusion heat treat at 900 deg. C plus/minus 10 deg. C for 4 hours in an inert gas atmosphere. Cool in air.
- N. Inspect Cooling Liners.
 - (1) Visually inspect the condition of the inner and outer brazed joints at the cooling liner flanges. If braze is absent, replace the liners as instructed in Chapter 72-51-02 Repair No.2 or No.5 as appropriate.
 - (2) Visually inspect the cooling liners for evidence of braze diffusion:
 - (a) Severe porosity.
 - (b) Excessive braze formation on surface.
 - (c) Penetration of liner section.
 - (d) General distress or deterioration of surface, resulting in reduction of wall section.

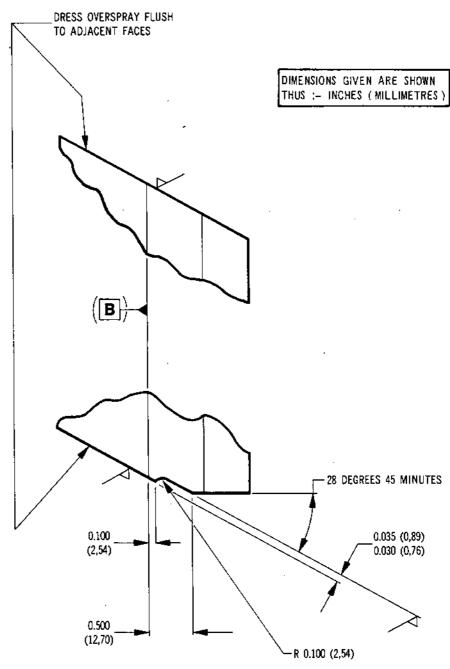
If any of the above conditions are evident, replace the liners as instructed in Chapter 72-51-02. Repair No.2 or No.5 as appropriate.

- P. Identify.
 - (1) Mark SALB512623 or R8 and the coating symbol (1) adjacent to the existing part number using vibro-percussion marking as specified in Chapter 72-09-00 Repair.
- Q. Final Inspection.
 - (1) Finally inspect to ensure the repair has been carried out satisfactorily and the vane assembly is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

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CR 36276/00A

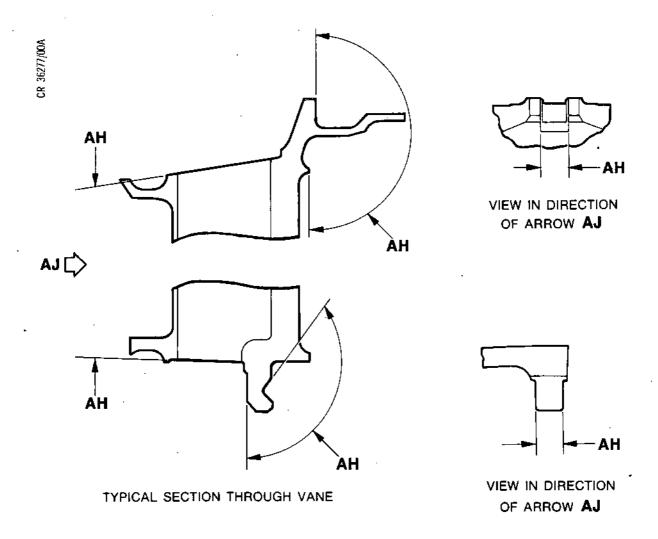


VIEW ON ARROW AG (REF FIG 403)

Seal Arm Machining Figure 404

> 72-51-02 Repair No.8 Page 409 Jun 1/90





Pack Aluminising Figure 405



5. Replacement Parts

None.

- 6. Removal of LCD22 Coating
 - A. Machine to remove the majority of the coating. Ensure the parent metal is not impared.

CAUTION: THE COOLING LINERS AND COOLING HOLES MUST BE BLANKED BEFORE BLASTING

- B. Mask off the vane and abrasive blast the coating using silicon carbide grit (36 mesh) at 30 to 35 psi. Blank off the cooling liners and cooling holes before blasting. For procedure, refer to Chapter 72-09-24 Repair.
- C. Mask off the brazed joints using Turco 522, and all internal passageways and cooling holes, using suitable masking tape.
- D. Immerse the seal arm only (Ref. Fig. 401) in concentrated hydrochloric acid (s.g. 1.18) at room temperature, using vigorous agitation for 0.5 hour.
- E. Rinse in cold water.
- F. Immerse in a neutralising solution e.g. 3% w/v sodium hydroxide.
- G. Rinse in cold water, rinse in hot water and air dry.
- H. Visually inspect.
- J. Repeat the procedure in paragraphs D to H.

CAUTION: THE COOLING LINERS AND COOLING HOLES MUST BE BLANKED BEFORE BLASTING

- K. Mask off the vane and abrasive blast the coated area using silicon carbide grit (36 mesh) at 30 to 35 psi. Blank off the cooling liners and cooling holes before blasting. For procedure, refer to Chapter 72-09-24 Repair.
- L. Repeat the procedure in paragraphs D to K if necessary, to remove the coating residue. The total maximum time allowed in the acid is 10 hours.

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7. Removal of Sulphidation

- A. Vapour degrease as instructed in Chapter 72-09-00 Cleaning.
- B. Chemically strip in 25% nitric acid for 2 to 3 hours as instructed in TSD 594 OP 122.
- C. Abrasive blast using 120/220 mesh alumina oxide grit as instructed in Chapter 72-09-24 Repair.
- D. Locally swab-etch the surface for a maximum of 2 minutes as instructed in Chapter 72-09-14 Repair, using solution E.
- E. Visually inspect for traces of sulphidation, which appear as black deposits.



VANE, ASSEMBLY OF, NOZZLE TURBINE

RESTORATION OF OUTER SEAL FACES, THIN WALL SECTIONS AND REPAIR OF CRACKS BY VACUUM BRAZING.

B512706-8

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | Part No. |
|------------|-----------|--|
| 72-51-02 | 1 /40B | B927580 B927583 B929042 B929043 B929044 B929045 |
| | 1A /40C | в927559 |
| | 1A /40D | B930564 B930567 B930568 B930569 B931328 B931329 B931330 B931331 |
| | 1 /508 | В927581 В927584 |
| | 1A /50C | B927561 |
| | 1A /50D | B930565 B930571 B930572 B930573 |
| | 1 /60B | в927588 в927585 |
| | 1 /60c | B927563 |
| | 1A /60D | B930566 B930575 B930576 B930577 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair instruction covers repair of the Vane, A/O, Nozzle Turbine (H.P.) at the following locations:

B512706 - Repair of cracks in various locations and restoration of thin wall sections in the aerofoil surface.

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B512707 - Restoration of the outer rear sealing surface by braze build up.

NOTE: This method of restoration will render assembly unsuitable for future restoration by Repair No.8.

B512708 - Restoration of the outer front conical seal face by braze build up.

Cracks greater than 0.040 (1,02) in width are not repairable by brazing must be welded to Repair Scheme B497463 (Refer 72-51-02 Repair No.4).

Any vanes with a thin wall section in the aerofoil surface less than 0.040 (1,02) thick must be rejected.

The maximum crack lengths repairable by brazing to Repair Instruction B512706 are given in Table A, Fig. 402.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO 1101 (JES 160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 TO 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO 1302 (JES 137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

- 1) Remove air cooling liners to appropriate repair scheme.
- 2) Remove rub tolerant coating from seal arm if component is marked RST 4097/1, B512623R8 or with coating symbol MC alternatively, if considered necessary, components on which the seat arm has not been previously repaired, or has been repaired by braze build up, may be machined to remove damage.

SUPPLEMENTARY INFORMATION

Refer Overhaul Manual Chapter 72-51-02 Repair no.2 or Repair no.5.

Refer Repair No.8.

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Repair No. 9
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OVERHAUL

Abrasive blast to remove all 3) traces of sulphidation using 120/220 mesh Alumina at 60 p.s.i.(414 kPa) or chemical strip. Inspect for complete removal of sulphidation.

Refer Overhaul Manual Chapter 72-09-24 Repair using OMat 146. Refer Appendix A. NOTE: Ensure vane cooling holes are free from obstruction.

4) Strip pack aluminised coating, blank off all holes to ensure no ingress of stripping solution. Any ingress of stripping solution must be removed.

Refer Overhaul Manual Chapter 72-09-05 Repair.

Check for complete removal 5) of pack-aluminising by heat tint.

Dry abrasive blast; refer Overhaul Manual Chapter 72-09-24 Repair. Do not handle prepared surfaces. Heat treat for 1 hour at 510-590°C in air, air cool. Visually inspect - a blue colour indicates base metal free from aluminising, a straw or gold colour indicates the presence of aluminising.

6) Abrasive blast to remove all traces of heat tint and etching using 120/220 mesh Alumina at 30 p.s.i.(207 kPa).

Refer Overhaul Manual Chapter 72-09-24 Repair using OMat 146. NOTE:

Ensure vane cooling holes are free from obstruction.

Clean component using a Rolls-7) Royce approved Halide or Fluorocarbon cleaning process.

Vendor sample to be supplied.

- 8) Apply braze stop-off as required.
- 9) Apply braze mix to cracks, outer seal features and thin wall sections as required.

MSRR 9500/724. Refer Repair Limitations.

10) Carry out a Rolls-Royce approved brazing heat treatment cycle.

Vendor sample to be supplied.

11) Remove braze stop-off.

REPAIR 72-51-02 Repair No. Page 403 Dec 1/95

12) Visually inspect repaired areas for adequate filling of cracks and build up of faces and aerofoil.

Repeat operations 8-11 if required.

13) Carry out a Rolls-Royce approved diffusion heat treatment cycle. Vendor sample to be supplied.

14) Dress/machine to restore aerofoil, outer seal features and side faces as necessary. Finish flush with existing surfaces, parent material not to be impaired.

Refer fig.403.

NOTE:
A variation of 0.003 (0,08) above the basic shape is acceptable on aerofoil surface.

15) Locally etch repaired areas on vane aerofoil.

Refer Overhaul Manual Chapter 72-09-14 Repair. using solution E

16) Inspect for cracks.

Refer Overhaul Manual Chapter 72-51-02 Inspection/check. Refer Appendix B.

17) Abrasive blast repaired areas using 120/220 mesh alumina at 30 p.s.i.(207 kPa).

Refer Overhaul Manual Chapter 72-09-24 Repair using OMat 146.

NOTE:

Ensure vane cooling holes are free from obstruction.

18) Check internal vane surfaces using a borescope to ensure adequate crack filling.

19) Restore leading and trailing edge cooling slots as required. The E.D.M. machining process is permissible.

Refer figs.404 and 405. Refer Overhaul Manual Chapter 72-09-23 Repair.

20) Pack aluminise all over, except where marked AD. Pack-aluminising thickness to be 0.001 (0,025) to 0.002 (0,05).

Refer Overhaul Manual Chapter 72-09-05 Repair. Refer fig.406.

21) Diffusion heat treat at 900°C + 10°C and soak for 4 hours in an inert gas atmosphere. Cool in air.

> REPAIR 72-51-02 Repair No. 9 Page 404 Dec 1/95



22) If necessary, replace rub tolerant coating.

Refer Repair No.8.

23) Replace air cooling liners to appropriate Repair scheme.

Refer Overhaul Manual Chapter 72-51-02 Repair no.2 or Repair no.5.

24) Mark Repair Instruction number RI B512706-8 or R9 A-C as applicable adjacent to normal 'assembly of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

APPENDIX A

CHEMICAL STRIPPING OF SULPHIDATION

- a) Vapour degrease. Refer chapter 72-09-00 (Cleaning).
- b) Chemically strip in 25% Nitric acid to TSD 594 op.122 for 2 to 3 hours.
- c) Abrasive blast using 120/220 alumina oxide grit (OMat 146). Refer chapter 72-09-24 (Repair).

INSPECTION FOR REMOVAL OF SULPHIDATION.

- a) Locally swab etch surface; maximum contact time 2 minutes. refer chapter 72-09-14 Solution E (Repair).
- b) Visually inspect for traces of sulphidation, this will normally appear as a black deposit.



APPENDIX B

POST REPAIR ACCEPTANCE STANDARD

GENERAL

ISOLATED POROSITY UP TO 0.015 (0,38) IS ACCEPTABLE PROVIDING IT DOES NOT FORM A CHAIN.

AEROFOIL

THREE LINEAR INDICATIONS UP TO 0.050 (1,27) LONG ARE ACCEPTABLE PROVIDING THEY ARE AT LEAST 0.250 (6,35) APART.

FILLET RADIUS (INNER AND OUTER)

THREE LINEAR INDICATIONS AT EACH FILLET RADII LOCATION UP TO 0.050 (1,27) LONG ARE ACCEPTABLE PROVIDING THEY ARE AT LEAST 0.250 (6,35) APART AND DO NOT REACH A PLATFORM EDGE.

5. MATERIAL

| COMPONENT | <u>MATERIAL</u> | <u>RR CODE</u> |
|--------------------------------------|------------------|----------------|
| VANE, ASSEMBLY OF, NOZZLE TURBINE | MSRR7138 PD21 | GID |

- 6. DATA
 - REFER TO APPROVED SUBCONTRACTOR.
- 7. <u>TOOLS</u>

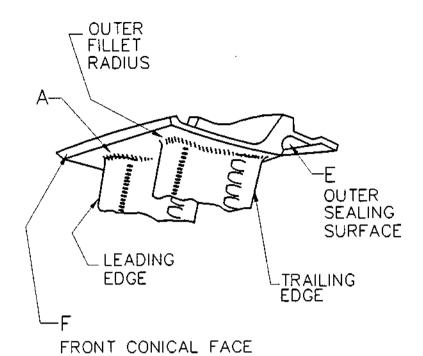
| TOOL NUMBER | <u>DESCRIPTION</u> | <u>item</u> |
|-------------|--------------------|-------------|
| NONE. | | |

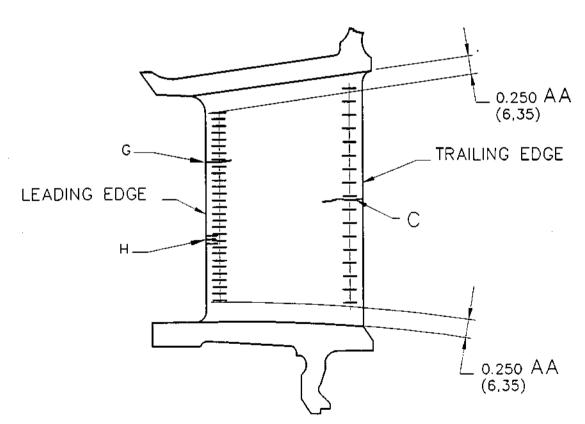
8. REPLACEMENT PARTS

NONE.

| PART NUMBER | <u>DESCRIPTION</u> | <u>ITEM</u> |
|-------------|--------------------|-------------|
| • | | |

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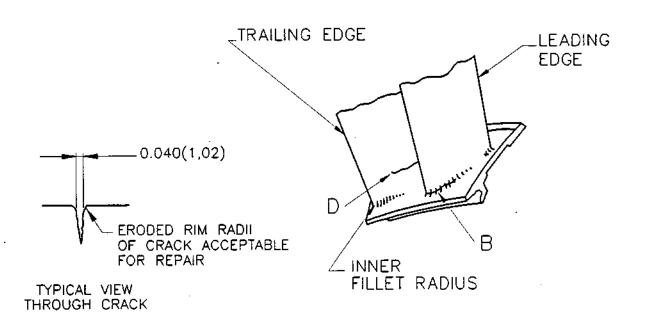




GENERAL VIEW SHOWING CRACK LOCATIONS FIG.401

REPAIR

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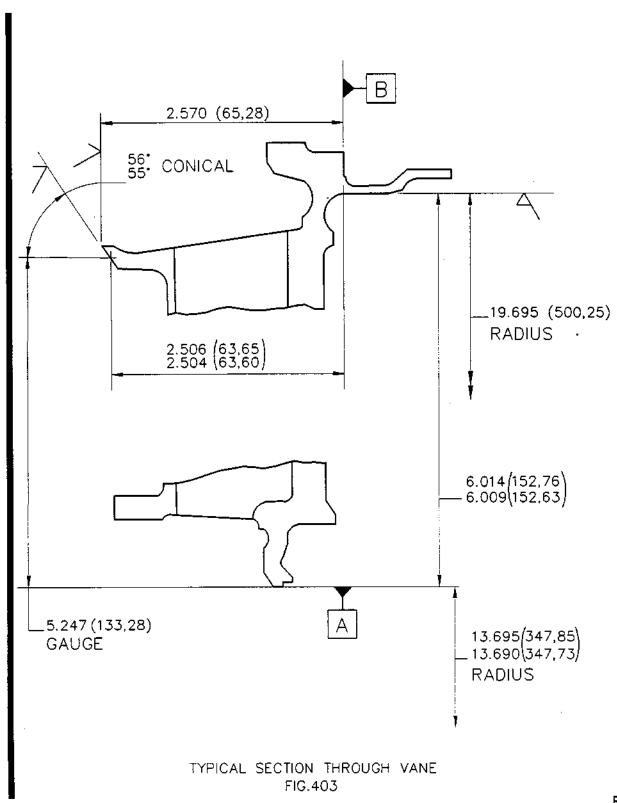


| TABLE A (APPLICABLE TO BOTH VANES) | | | |
|---|------------------|------------------|-------------|
| CRACK LOCATION | MAXIMUM | MINIMUM | MAXIMUM No. |
| | LENGTH | DISTANCE TO | OF CRACKS |
| | OF CRACK | NEAREST CRACK | PER VANE |
| A | 1.500 | 0.500 | 6 |
| (OUTER FILLET RADIUS) | (38,10) | (12,70) | |
| B' (INNER FILLET RADIUS) | 1.500 (38,10) | 0.500 (12,70) | 6 |
| C | 1.000 | 0.500 | 4 |
| (T/E EXCEPT WITHIN AA) | (25,40) | (12,70) | |
| D (MID SPAN AEROFOIL CONVEX AND CONCAVE) | 1.500 (38,10) | 0.500 (12,70) | 6 |
| G | 1.000 | 0.500 | 4 |
| (L/E EXCEPT WITHIN AA) | (25,40) | (12,70) | |
| H (L/E IN CLOSE PROXIMITY EXCEPT WITHIN AA) | 0.750 (19,05) | | |

GENERAL VIEW SHOWING CRACK LOCATIONS FIG. 402

REPAIR

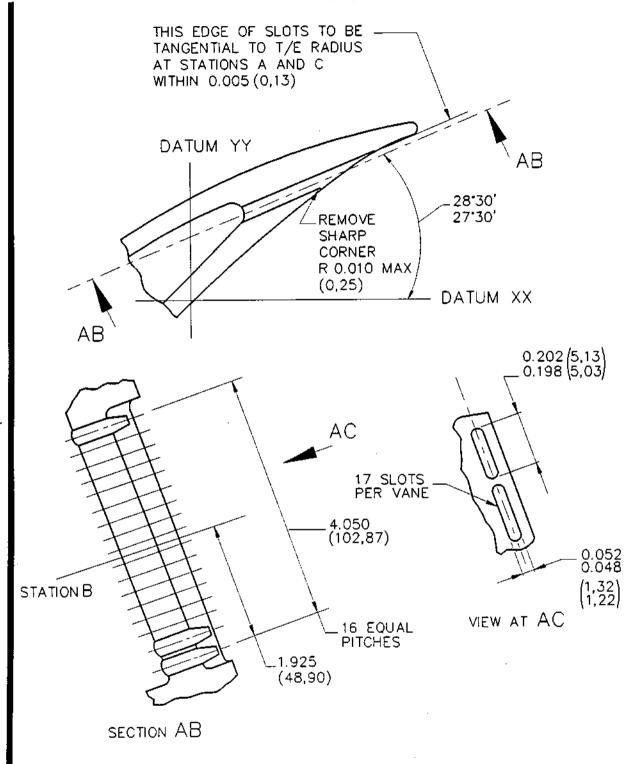
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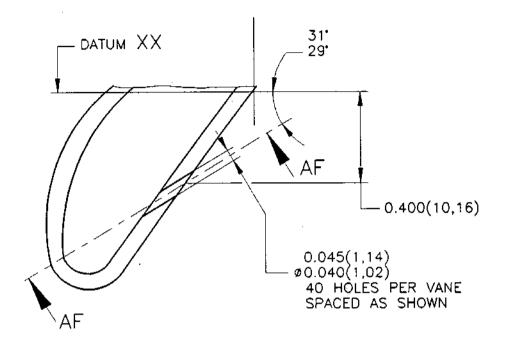
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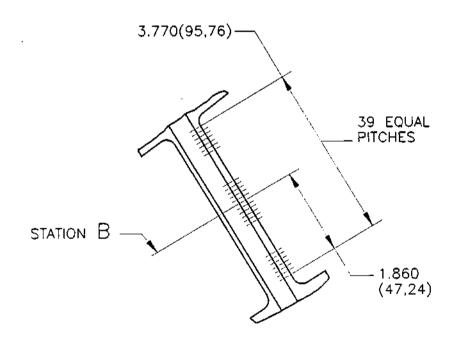




TYPICAL SECTION THROUGH T/E COOLING HOLE
. FIG.404

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SECTION AF

TYPICAL SECTION THROUGH L/E COOLING HOLE FIG.405

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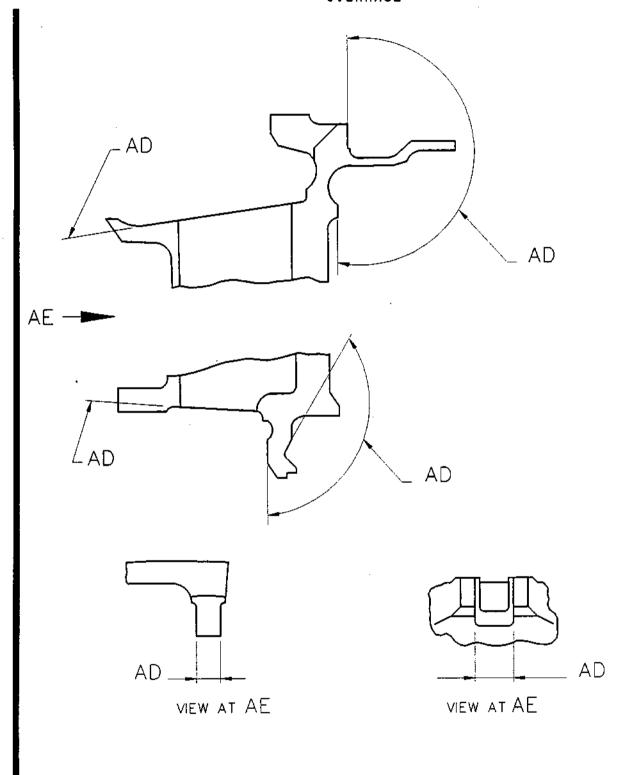


FIG.406

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HP TURBINE NOZZLE VANE RING ASSEMBLY - REPAIR RESTORATION OF FRETTED RETAINING SLOT LOCATIONS BY WELDING

REPAIR NO.B513474

1. Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|-----------|----------|
| 72-51-02 | .1 10A | в445479 |

Introduction

A. General.

- (1) This repair describes the procedure for restoring the retaining slots of the HP Nozzle Vane Ring Assembly by welding.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0.50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Tolerances on machined angles are plus/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of these repairs should be achieved without deviation. Where a need to deviate is considered necessary, agreement should first be sought from the Repair Authority.
- (2) Fretting on any one or on all 32 slots may be repaired up a maximum depth of 0.020 in. (0.50 mm).

Instructions

- A. Preparation.
 - (1) Refer to Figure 404 and Chapter 72-09-00, Repair, para.9. Remove existing anchor nuts.

REPAIR

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(2) Refer to TSD 594-409. Thoroughly clean fretted slot locations in preparation for welding.

B. Weld.

- (1) Refer to Figure 403 and TSD 594-409.
- (2) Using filler rods to MSRR 9500/16, build up fretted areas by argon arc welding.

NOTE: Repair weld is not to encroach within 0.050 in. (0,13 mm) of base of slot.

C. Inspect.

(1) Carry out crack detection procedure as specified for this component at Chapter 72-51-02, Inspection/Check on repaired areas.

D. Heat Treat.

(1) Heat treat at 800°C plus/minus 10°C for 8 hours. Allow to cool in air.

E. Inspect.

(1) Carry out crack detection procedure as specified for this component at Chapter 72-51-02, Inspection/Check on repaired areas.

F. Machine.

- (1) Refer to Figures 401 and 402. Mount the component in a milling machine and set true to datum A.
- (2) Reproduce repaired slots to the dimensions shown.
- (3) Using conventional hand tools, carefully blend machining step as required. Remove all sharp edges:

G. Inspect.

(1) Refer to Figures 401 and 402. Check the slot dimensions are correct.

NOTE: Dimensions are to be measured with the component in the restrained state.

(2) Carry out crack detection procedure as specified for this component at Chapter 72-51-02, Inspection/Check on repaired areas.

REPAIR

72-51-02

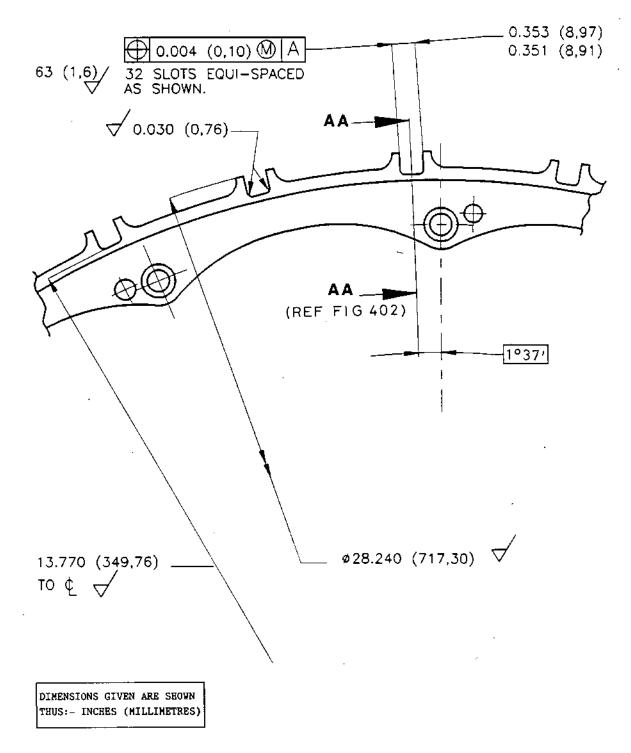


- H. Replace Anchor Nuts.
 - (1) Refer to Figure 404 and Chapter 72-09-00, Repair. Fit new anchor nuts (see para.5., Replacement Parts, of this instruction).
- J. Identify.
 - (1) Mark the component SAL B513474 adjacent to the existing part number using vibro-percussion engraving marking as specified in Chapter 72-09-00, Repair.
- K. Final Inspection.
 - (1) Finally inspect component to ensure repair has been carried out satisfactorily and that the HP Turbine Nozzle Vane Ring Assembly is serviceable.
- 4. Special Tools, Fixtures and Equipment

None.

Replacement Parts

| Part Number | Component | Qty. |
|-------------|-------------------|------|
| AS27870 | Nut, Self locking | 16 |

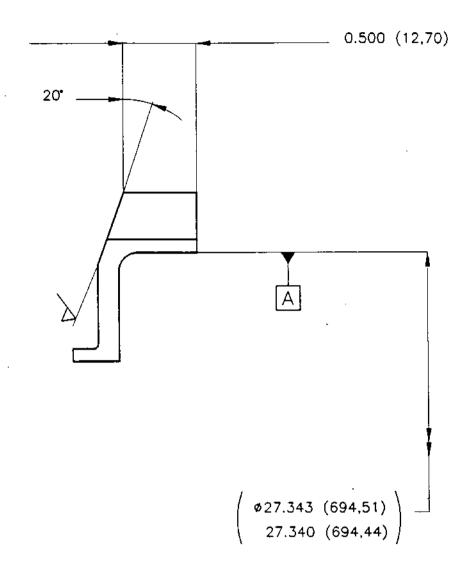


HP Turbine Nozzle Vane Ring Assembly Figure 401

REPAIR

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SECTION AA (REF FIG 401)

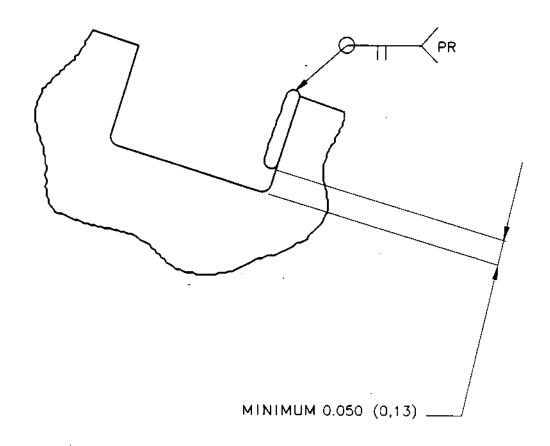
DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

HP Turbine Nozzle Vane Ring Assembly Figure 402

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TYPICAL VIEW SHOWING WELDING OF SLOT

DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

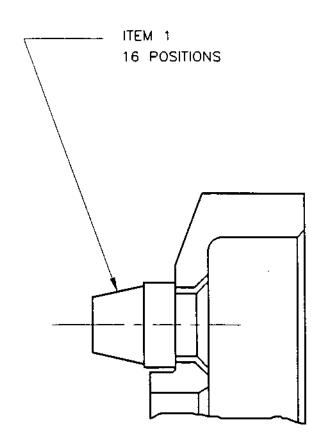
HP Turbine Nozzle Vane Ring Assembly Figure 403

REPAIR

72-51-02

Repair No.10 Page 406 Jun 1/91





TYPICAL VIEW SHOWING SELF LOCKING NUTS

DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

HP Turbine Nozzle Vane Ring Assembly Figure 404

REPAIR

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LINER ASSEMBLY OF

REPLACEMENT OF OUTER LINER

REPAIR NO. B499447

1. <u>EFFECTIVITY</u>

 IPC
 Fig./Item
 Part No.

 72-51-02
 901A
 B497471

 909A
 B497472

2. REPAIR_LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

Cut off/through damaged outer Refer Fig. 401. liner and dress back to centre Refer Para.7. TOOLS, item 1. line of existing weld.

- 2) Dye penetrant inspect component. Refer TSD 594 OP.213
- 3) Assemble replacement Outer Liner Refer Fig. 401.
 to dressed end of Centre Liner. Refer Para.8. REPLACEMENT PARTS, item 3.
- 4) Inert Gas Arc weld Outer Liner to Centre Liner.

Refer TSD 594 OP.409 Use filler wire OMat 3/305. Refer Para.7. TOOLS, item 2. Refer Fig.401.

SUPPLEMENTARY INFORMATION

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REPAIR



| 5) | Dimensionally ins | sect component. | Refer Fig. 401. | |
|----|--|------------------------|-----------------|-------------|
| 6) | Visually inspect there is no obstructions hole. | | | |
| 7) | Dye penetrant insp | sect component. | Refer TSD 594 | OP.213 |
| 8) | Mark Repair Instru RI B499447 or R11 attach to compone | on label and | | |
| 5. | MATERIAL | | | |
| | COMPONENT | <u>MATERIAL</u> | | RR CODE |
| | LINER ASSEMBLY OF | MSRR 7005 Nimonic 7 | | QAS |
| 6. | DATA | | | |
| | NONE. | | | |
| 7. | TOOLS | | | |
| | TOOL NUMBER | DESCRIPTION | | ITEM |
| | \$3\$13620000 | TRIMMING BLOCK | , | 1 |
| | \$3\$13621000 | WELDING FIXTURE | | 2 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | DESCRIPTION | | <u>ITEM</u> |
| | B470429 | LINER OUTER | | 3 |

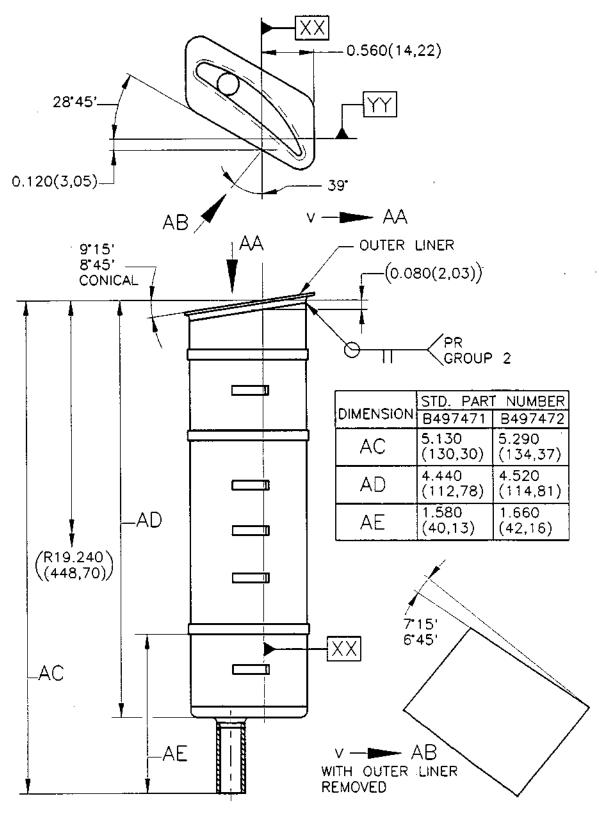


FIG.401

REPAIR

72-51-02 Repair No.11 Page 403 Jan 31/94



LINER ASSEMBLY OF

REPLACEMENT OF TUBE END

REPAIR NO. B499448

1. EFFECTIVITY

 IPC
 Fig./Item
 Part No.

 72-51-02
 901A
 B497471

 909A
 8497472

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE SUPPLEMENTARY INFORMATION

- 1) Cut off/through damaged Tube Refer Fig.401.
 End and dress back to centre Refer Para.7. TOOLS, item 1.
 Line of existing weld.
- 2) Dye penetrant inspect component. Refer TSD 594 OP.213
- 3) Assemble replacement Tube End to Refer Fig. 401. dressed end of Centre Liner. Refer Para.8. REPLACEMENT PARTS, item 3 or 4 (as applicable).
- 4) Inert Gas Arc weld Tube End to Centre Liner.

Refer TSD 594 OP.409 Use filler wire OMat 3/305. Refer Para.7. TOOLS, item 2. Refer Fig.401.

REPAIR

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| 5) | Dimensionally insp | ect component. | Refer Fig.401. | |
|----|---|------------------------|----------------------------------|---------------------|
| 6) | Visually inspect t there is no obstru cooling hole. | | | |
| 7) | Dye penetrant insp | ect component. | Refer TSD 594 | OP.213 |
| 8) | Mark Repair Instru RI B499448 or R12 attach to componen | on label and | Refer Overhaul Chapter 72-09- | Manual OO Repair |
| 5. | MATERIAL | | | |
| | COMPONENT | MATERIAL | | RR CODE |
| | LINER ASSEMBLY OF | MSRR 7005 Nimonic 7 | | QAS |
| 6. | DATA | | | |
| | NONE. | | | |
| 7. | TOOLS | | | |
| | TOOL NUMBER | DESCRIPTION | | <u>item</u> |
| | \$3\$13620000 | TRIMMING BLOCK | | 1 |
| | \$3\$13621000 | WELDING FIXTURE | | 2 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | DESCRIPTION | | <u>ITEM</u> |
| | APPLICABLE TO PART | T NUMBER 8497471 | ONLY. | |
| | B477487ND | END TUBE | | 3 |
| | APPLICABLE TO PART | T NUMBER B497472 | ONLY. | |
| | B470435 | END TUBE | | 4 |
| | | | | |

REPAIR
72-51-02
Repair No.12
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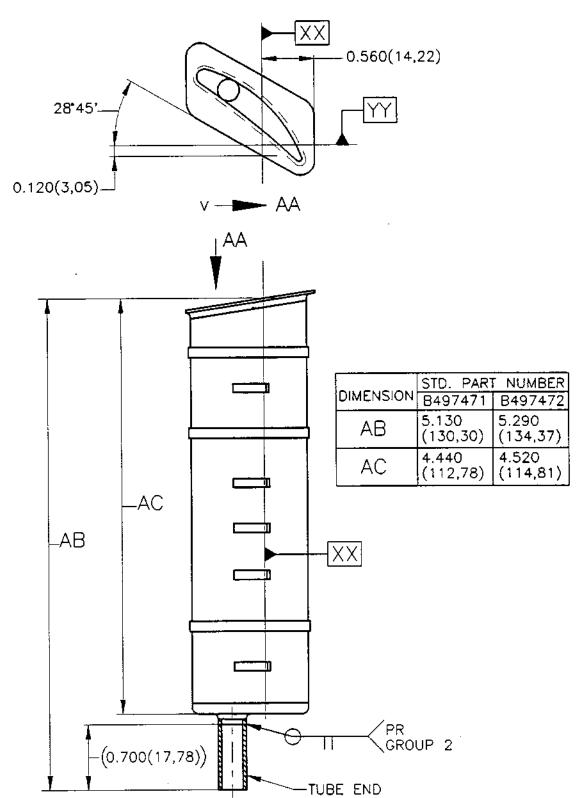


FIG.401

REPAIR 72-51-02 Repair No.12 Page 403 Jan 31/94



LINER ASSEMBLY OF

REPLACEMENT OF INNER LINER AND TUBE END

REPAIR NO. B499449

1. <u>EFFECTIVITY</u>

| IPC | Fig./Item | <u>Part No.</u> |
|----------|-----------|-----------------|
| 72-51-02 | 901A | B497471 |
| | 909A | B497472 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Cut off/through damaged Inner Liner and dress back to centre line of existing weld.
- Refer Fig. 401.
 Refer Para.7. TOOLS, Item 1.
- Dye penetrant inspect component.
- Refer TSD 594 OP.213
- 3) Assemble replacement Inner Liner and Tube End to dressed end of Centre Liner.
- Refer Fig. 401.
 Refer Para.8. REPLACEMENT
 PARTS, items 3 and 4 or 3 and
 5 (as applicable)
- 4) Inert Gas Arc weld Inner Liner and Tube End to Centre Liner.

Refer TSD 594 OP.409 Use filler wire OMat 3/305. Refer Para.7. TOOLS, Item 2. Refer Fig.401.

REPAIR

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Repair No.13
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| 5) | Dimensionally inspe | ect component. | Refer Fig.401. | |
|----|--|------------------------|-----------------------------------|----------------------|
| 6) | Visually inspect to there is no obstruct cooling hole. | | | |
| 7) | Dye penetrant inspe | ect component. | Refer TSD 594 0 | P.213 |
| 7) | Mark Repair Instruction RI 8499449 or R13 cattach to component | on label and | Refer Overhaul Chapter 72-09-0 | Manual)O Repair. |
| 5. | MATERIAL | | | |
| | COMPONENT | MATERIAL | | RR CODE |
| | LINER ASSEMBLY OF | MSRR 7005 Nimonic 7 | | QAS |
| 6. | DATA | | | |
| | NONE. | | | |
| 7. | TOOLS | | | |
| | TOOL NUMBER | DESCRIPTION | | <u>ITEM</u> |
| | \$3\$13620000 | TRIMMING BLOCK | | 1 |
| | \$3\$13621000 | WELDING FIXTURE | | 2 |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER | <u>DESCRIPTION</u> | | ITEM |
| | B470434 | LINER INNER | | 3 |
| | APPLICABLE TO PART | NUMBER B497471 | ONLY. | |
| | B477487ND | TUBE END | | 4 |
| | APPLICABLE TO PART | NUMBER 8497472 | ONLY. | |
| | B470435 | TUBE END | | 5 |
| | | | | |



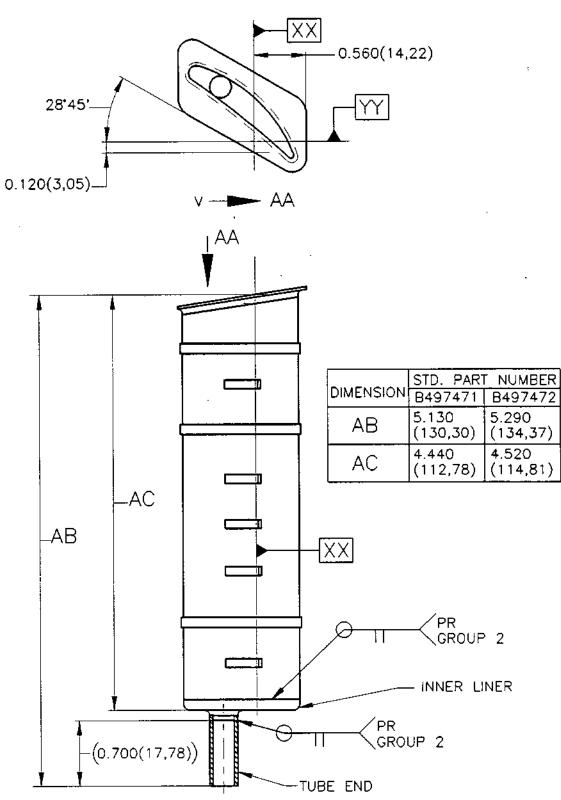


FIG.401

REPAIR

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British airways

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-511
Insert in 72-51-02 at rear of repair sec. in RST No. order

REASON FOR ISSUE:

Damage to pack aluminised coating on H.P. turbine N.G.V.'s (MRA 61).

ACTION

D:

BEOL REPAIR: RST 4005. H.P. Turbine N.G.V.'s. Repair to damaged pack aluminised coating by application of Sermaloy 'J'.

PROCEDURE:-

- 1. Apply Sermaloy 'J' in accordance with the process quoted in the Rolls-Royce Overhaul Process Manual TSD.594 Op.339 Part 4.
 - N.B. (a) No deviation from the quoted process is permitted.
 - (b) Any amount of the pack aluminised coating may be repaired.
 - (c) Observe the CAUTION NOTE on Page 22 (TSD.594 339) warning of the highly toxic nature of Sermaloy 'J'.
 - (d) Application of Sermaloy 'J' by spray gum is preferred for coating thickness control and coating integrity and is the recommended method. Minor areas of coating damage may, however, be repaired using a suitable brush (Refer Opn.7 Page 23 of TSD.594 339). Observe the caution regarding the skill of the operator.
- 2. Diffusion heat treat for two hours at 870°C to 890°C in argon with a volume change of six times per hour.

British airways

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-548

Insert in 72-51-02 at rear of repair section in RST No. order

REASON FOR ISSUE:

H.P. turbine N.G.V.'s multiple hairline cracking of leading edge (MRA 129)

ACTION

B.E.O.L. REPAIR

RST 4032 POLISH LEADING EDGE OF H.P.

N.G.V'S TO REMOVE MULTIPLE HAIRLINE

CRACKING.

PROCEDURE: This repair may be applied once only per vane.

- Dress and polish leading edge to remove multiple hairline cracking.
 - NOTES: a) A maximum of .Oll" of parent material is to be removed.
 - b) Original leading edge contours must be maintained.
- 2. Crack test per normal Overhaul Manual procedure.
- 3. Restore leading pack aluminised coating per RST. 4005.
- 4. Vibro-engrave 'RST. 4032' on suitable position on inner platform of repaired vane.
- 5. Finally Inspect.
- 6. The above is written per OLY/SEDP/816.

TR.72-548 72-51-02 RST 4032 TR.Page 1 of 1



HP TURBINE ROTOR - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|-----------|------------|--|---------------|
| בווארמווס | 1 | HP Turbine Disks Repaired by Blending to Remove Light Impact and Other Damage | SAL.B.497541 |
| <u> </u> | 2 | HP Turbine Disks Repaired by Blending to Remove Light Scores in the Bore and on Faces | SAL.B.497591 |
| Printed | 3 | <pre>HP Turbine Disks Repaired by Blending Damage/Defects in Bolt Holes</pre> | SAL.B.499496 |
| | 4 | CANCELLED | |
| | 5 | <pre>HP Turbine Blade - Restoration of Worn Sealing Fin by Welding</pre> | SAL.B.513482 |
| | 6 | Blade, Assembly of, Turbine, HP Blending of Damaged and/or Cracked Shroud Seal Fin | \$AL.B.513483 |
| | 7 | Disk, Turbine Rotor, HP Removal of Flank Face Fretting from Hirth Serration Couplings by Grinding. | SAL.B.516017 |



HP TURBINE DISKS - REPAIR BY BLENDING TO REMOVE LIGHT IMPACT AND OTHER DAMAGE

MODIFICATION NO. OL.8740C AND 8778C

1. Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|----------------|---|
| 72-51-03 | 1 70C 1 70D | B.931838-55 B.931800-17 B.933165-68 B.933178 |

2. Introduction

A. General.

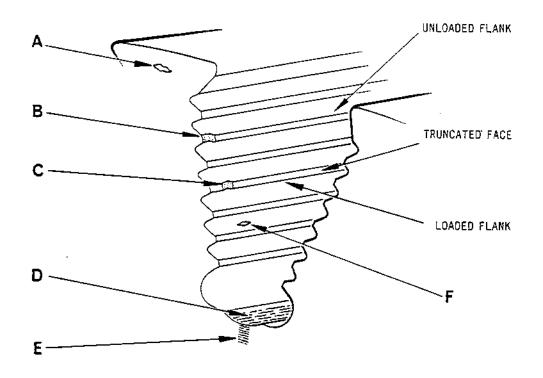
CAUTION:

THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NO.CMTlol/B497541.

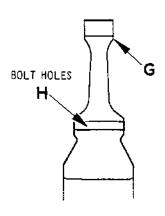
- (1) This repair describes the procedure for removing light impact and other damage from the broached root forms of disks by blending using conventional hand tools.
- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETERS).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Operations detailed in this repair procedure that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.
- B. Repair Limitations.
 - Damage to loaded flanks (Ref.Fig.401) is not acceptable.

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- A SMALL AREAS, LIGHT IMPACT DAMAGE (FRONT OR REAR FACE)
- B CORNER, LIGHT IMPACT DAMAGE
- C LIGHT IMPACT DAMAGE
- D LIGHT SCRATCHES IN ROOT OR RELIEF, CAUSED BY LOCKING TAG
- E LIGHT FRET MARKS FROM BLADE TANG (REAR FACE ONLY)
- F LIGHT DAMAGE ON UNLOADED FLANK
- G IMPACT DAMAGE ON RADIUSED EDGE (REAR FACE TO CONCAVE FACE)



Typical Damage Forms and Areas Figure 401

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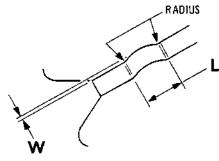
TANGENT OF ROOT RADIUS

ALTERNATIVE METHODS FOR AREA B

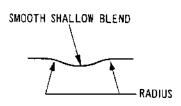
(SEE FIG 401)

CONVEX RADIUS BLEND

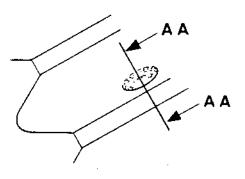
CONCAVE RADIUS BLEND



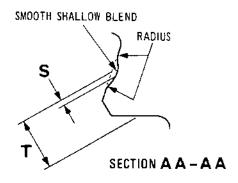
FOR AREA C (SEE FIG 401)



TYPICAL FOR AREAS A AND E
(SEE FIG 401)



FOR AREA F (SEE FIG 401)



Blending Details Figure 402

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(2) Blend depth maximums are as follows:

Area (Ref.Fig.401)

Maximum Blend Depth (Ref.Fig.402)

Α

0.005 in. (0,127 mm).

B and C For C, W max = 0.010 in. (0,25 mm) 'W x L' must not exceed 10% of the surface area of loaded flank face.

D and E (Critical Areas)

0.002 in. (0.05 mm).

F

Depth S not to exceed 10% of T.

G

0.010 in. (0,25 mm).

(3) No blend to extend below XX (Ref.Fig.402).

3. Instructions

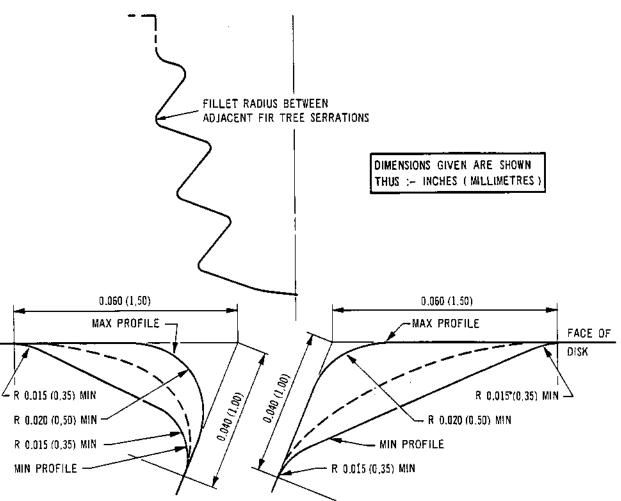
- A. Blend and Polish.
 - (1) Hand blend the damaged areas, in accordance with Overhaul Manual Chapter 72-09-22, Repair within limitations, to remove damage, using conventional hand tools and produce radii as required at intersection of blend and flank (Ref.Fig.401 and 402). When blending area B the edge between the disk face and the serration must be radiused. The aim is to produce a radiused form, but a chamfer blended at the corners is acceptable, provided it falls within the dimensions shown in Fig.403.
 - (2) Polish areas blended to achieve a surface finish of 63 micro inches (1,6 micrometers). Area D (Ref.Fig.401) must only be hand polished using fine grade emery cloth.
- B. Inspect.
 - (1) Mask off bolt holes H (Ref.Fig.401) using a suitable masking medium.
 - (2) Locally etch the blended areas in accordance with the procedure detailed in Chapter 72-09-14, Repair, using solution C.

REPAIR

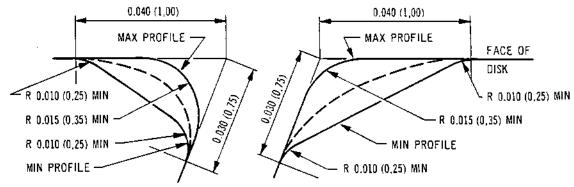
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CR 35590/00A





FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS 0.35 (0.90) OR MORE



FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS LESS THAN 0.35 (0.90)

ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN. BROKEN LINES INDICATE TYPICAL PROFILE.

Radiusing Fir Tree Serration/Disk Face Edge Figure 403

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- (3) Locally test the blended areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-03, Inspection/Check. CMT
- (4) Remove masking from bolt holes H (Ref.Fig.401).
- C. Shot Peen.
 - (1) Locally shot peen the blended areas using the following procedure and the details shown in Chapter 72-09-15 OR TSD 594-338:
 - (a) Process Classification:
 Controlled Shot Peen.
 - (b) Peening Medium:

 Steel Shot M.I.C. Grade M.I.170 4-8A Intensity.
 - (c) Peening Test Strip:
 Almen Type A.
 - (d) Arc Height: 0.004/0.008 in. (0,1/0,2 mm).
 - (e) Other Conditions:

Peening test strip check to be carried out immediately prior to peening each component or batch of components.

- D. Identify.
 - (1) Using the vibro-percussion engraving technique Ref. Chapter 72-09-00, Repair, mark on SAL B.497541 or R1 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.

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- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.
- 4. Special Tools, Fixture and Equipment

None required.

5. Replacement Parts

None required.

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HP TURBINE DISKS - REPAIR BY BLENDING TO REMOVE LIGHT SCORES IN THE BORE AND ON FACES MODIFICATION NO. OL.8759C

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u>

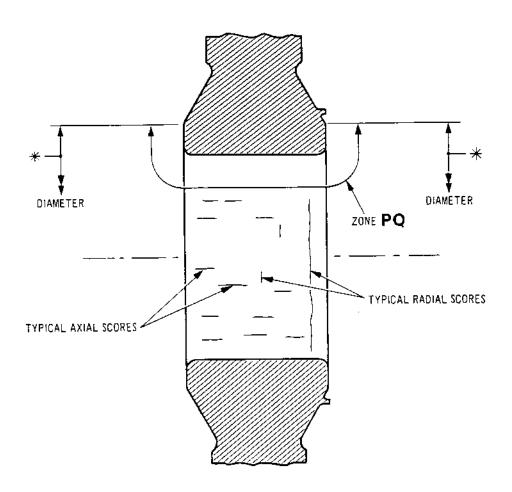
72-51-03 1 700 B.931800-17
B.933165-68
B.933178

A. General.

CAUTION: THIS PROEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NO. CMT 101/B.497591.

- (1) This repair describes the procedue for blending light scores in the bore and on the disks.
- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETRES).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Operations detailed in this repair procedure that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.

REPAIR



* DEFINED AS FULL EXTENT OF FLAT SURFACE

Area and Type of Damage Figure 401

72-51-03 Repair No.2 Page 402 Sep 1/80



- B. Repair Limitations.
 - (1) Scores in faces and bore within area defined as PQ (Ref.Fig.401), up to a maximum depth of 0.002 in. (0.05 mm) may be blended.

3. <u>Instructions</u>

- A. Blend and Polish.
 - (1) Hand blend the damaged areas, in accordance with Overhaul Manual Chapter 72-09-22, Repair within limitations, to remove scores, by polishing with fine grade emery cloth. Blends must be smooth, continuous, free from scratches and polished to achieve a surface finish of 63 microinches (1,6 micrometers).
- B. Inspect.
 - (1) Locally swab etch the blended areas in accordance with the procedure detailed in 72-09-14, Repair, using Solution C.
 CMT
 - (2) Locally test the blended areas for cracks using the fluorescent dye penetrant process specified for this component in 72-51-03, Inspection/Check.
 CMT
- C. Vapour Blast.
 - (1) Locally vapour blast the etched areas in accordance with 72-09-13, Repair, using procedure B. Overblast is acceptable.
 CMT
- D. Identify.
 - (1) Using the vibro-percussion engraving technique Ref.72-09-00, Repair, mark on SAL. B.497591 or R2 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.
- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.

REPAIR



- 4. Special Tools, Fixtures and Equipment
 None required.
- 5. Replacement Parts
 None required.



HP TURBINE DISK - REPAIR BY BLENDING DAMAGE/DEFECTS IN BOLT HOLES MODIFICATION NO. OL.8785C

1. Effectivity

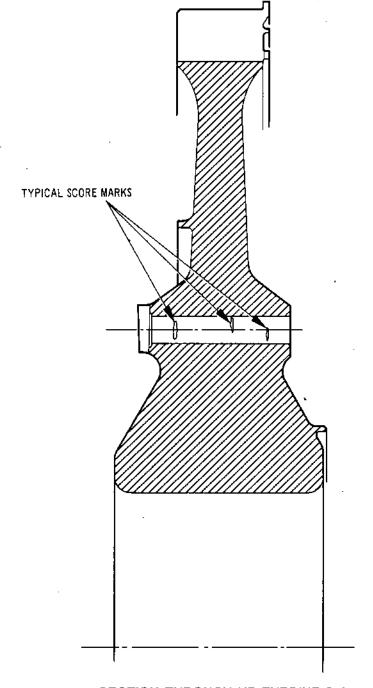
| I.P.C. | Fiq./Item | <u>Part No.</u> |
|-------------------|-------------------------|--|
| 72-5 1- 03 | 1 70A 1 70B 1 70D | B.925342 B.925897 B.931800 B.931801 to 931817 B.933165 to 933168 |
| | | R 933178 |

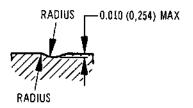
Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NO. CMT 101/8.499496.

- (1) This repair describes the procedure for removing damage/defects from the disk bolt holes.
- (2) Refer to 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (3) Operations that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.
- B. Repair Limitations.
 - (1) Blends must not exceed 0.010 in. (0,25 mm) in depth as shown in Fig. 401.
 - (2) This repair may be applied to any number of the disk bolt holes.





TYPICAL BLENDING

DIMENSIONS GIVEN ARE SHOWN Thus:- inches (Millimetres)

SECTION THROUGH HP TURBINE DISK

Blending Details Figure 401

72-51-03

Repair No.3

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3. Instructions

- A. Blend and Polish.
 - (1) Hand blend to remove damage, in accordance with Overhaul Manual Chapter 72-09-22, Repair within the limits shown in Fig.401, using fine grade emery cloth. Blends must be smooth, free from scratches and polished to achieve a surface finish of 32 micro-inches (0,8 micrometres).

B. Inspect.

(1) Locally etch the blended areas in accordance with the procedure detailed in 72-09-14, Repair, using solution C.

CMT

(2) Inspect the blended areas for cracks by the fluorescent dye penetrant method using the process recommended for this component in 72+51-03, Inspection/Check.

CMT

(3) Carry out an eddy current check of the bolt holes as detailed in Service Bulletin 0L.593-72-8524-242.

CMT

C. Shot Peen.

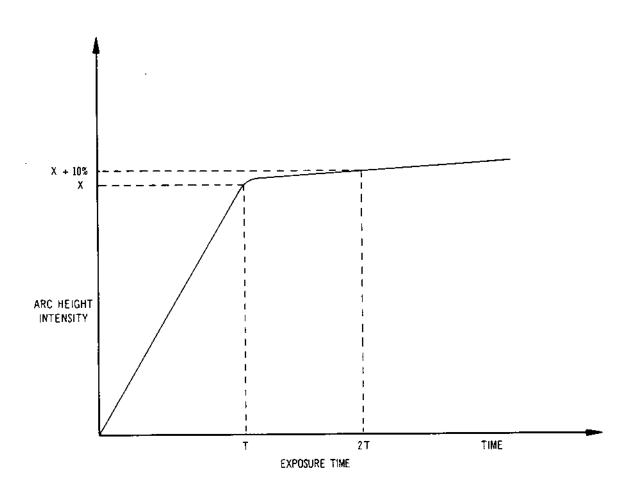
(1) Before carrying out the shot peening operation, an Almen test specimen strip type A (as specified by the S.A.E. Almen Test Specimen for Shot Peening Control) must be processed in order to control the blast intensity.

The test strip shall be processed adhering to the following instructions:

- (a) The test strip is to be shot peened under the specified conditions to give the specified arc height; use the shot detailed subsequently in para.(2).
- (b) The test strip arc height must be satisfactory before the components represented are processed.

REPAIR

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T=SATURATION TIME=100 PER CENT COVERAGE
2T=SATURATION MUST NOT INCREASE BY MORE THAN
10 PER CENT WHEN EXPOSURE TIME IS DOUBLED,
1.E. 200 PER CENT COVERAGE
X=INTENSITY REQUIRED

Shot Peening Exposure Time Intensity Determination Curve Figure 402

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- (c) The minimum requirement for the production of a test strip is at four hours or every change of component type.
- (d) The test strip shall be held in the appropriate fixture and peened under the same parameters as the component represented, ensuring uniform coverage of the exposed surface.
- (e) After treatment, the test strip shall be removed from the fixture and blown free of any adherent dust. The arc height shall be measured on the standard gauge.
- (f) The Almen arc height refers to the resultant deflection when the test piece is peened uniformly for sufficient time to saturate the whole of the exposed face. By plotting arc height against exposure time for a given set of conditions a curve of the type shown in Fig. 402 is obtained. The test piece surface is saturated at the point where the curve levels off. The arc height at saturation point shall not increase by more than 10% when the exposure time is doubled.
- (2) Shot peen bolt holes to which blending procedure has been applied (overblast is acceptable).

CMT

- (a) Shot peen using M.I.C. grade 170 shot at 4-8A intensity and 200% coverage.
- D. Identify.
 - (1) Using the vibro-percussion engraving technique Ref.72-09-00, Repair, mark on SAL.B.499496 or R.3 next to the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,76 mm) minimum.
- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure that the repair has been carried out satisfactorily and that the disk is in a serviceable condition.

REPAIR

72-51-03
Repair No.3
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HP TURBINE BLADE - REPAIR BY BLENDING TO REMOVE SURFACE DEFECTS

MODIFICATION NO. OL.8807C

Effectivity

| I.P.C. | Fig., | <u>/Item</u> | Part No. | |
|----------|-------|--------------|------------------------|--|
| 72-51-03 | 1 | 308 | в.927342 | |
| | 1 | 30c | B.930865 | |
| , | 1 | 3 O D | B.934172, B.934186, | |

2. Introduction

- A. General.
 - (1) This repair describes the procedure for removing impact damage, thermal fatigue and oxidation/sulphidation from the leading edge of HP turbine blades, by blending and polishing within specified limits, followed by the application of pack aluminized coating.
 - (2) Refer to 72-09-00, Repair, for all standard practices applicable to this repair procedure.
 - (3) This repair may be applied once only.

3. Instructions

- A. Prepare Blade for Blending and Polishing.
 - (1) Remove the pack aluminized coating from the blade in accordance with the procedure detailed in 72-09-05, Repair.

- (2) Inspect the blade using the fluorescent dye penetrant process specified for this component in 72-51-03, Inspection/Check and apply the following acceptance limits in conjunction with Figure 401.
 - NOTE: Defects which may have been acceptable at the time of blade manufacture could deteriorate as a result of the pack aluminizing removal process. The acceptance standards quoted, apply to these type of defects as distinct from defects which have occurred during service and for which separate acceptance standards are given in 72-51-03, Inspection/Check.
 - (a) Any section of the blade.
 - (i) No cracks or areas of shrinkage are acceptable.
 - (b) Area at leading and/or trailing edge.
 - (i) No defects are permitted within 0.063 in. (1,59 mm) of the leading and/or trailing edge next to zone B.
 - (ii) Defects up to 0.010 in. (0,25 mm) diameter are permitted within 0.063 in. (1,59 mm) of the leading and/or trailing edge next to zone A (dye indication not greater than 0.031 in. (0,79 mm) diameter).
 - (c) Zone A both sides of blade.
 - (i) Defects up to 0.010 in. (0,25 mm) diameter are acceptable.
 - (ii) Defects between 0.010 in. and 0.031 in. (0,25 and 0,79 mm) diameter (dye indication not greater than 0.094 in. (2,38 mm) diameter) are acceptable provided that they are not less than 0.188 in. (4,76 mm) apart.

SHROUD CR 35895/00A 0.063 (1,59) - 0.063 (1,59) LEADING EDGE TRAILING EDGE 2.25 (57,15) **PLATFORM** DEFECTS NOT PERMITTED IN THESE AREAS OR WHERE MARKED ----ON LOBE **FLANKS** DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) R 0.040 (1,01)

ENLARGED VIEW OF BLADE ROOT

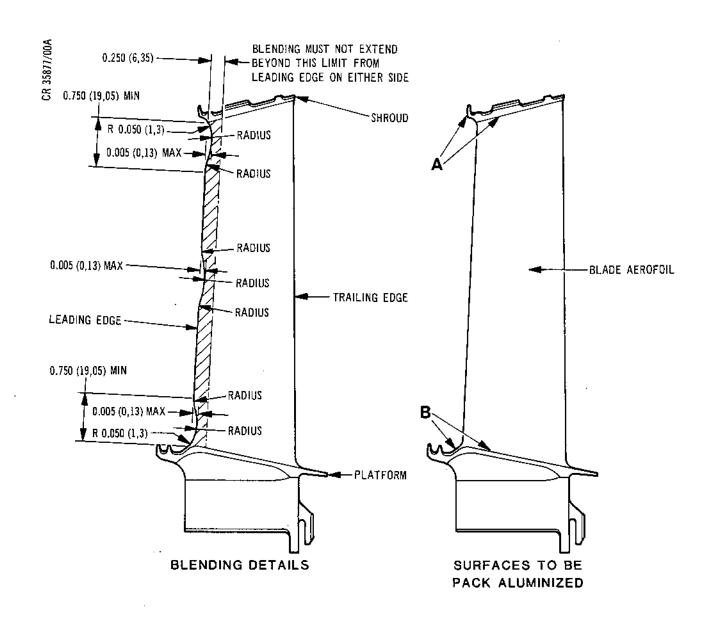
HP Turbine Blade Inspection Details Figure 401

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Repair No.4
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- (d) Zone B both sides of blade.
 - (i) Defects up to 0.010 in. (0,25 mm) diameter are acceptable.
 - (ii) Defects between 0.010 in. and 0.020 in. (0,25 and 0,51 mm) diameter (dye indication not greater than 0.063 in. (1,59 mm) diameter) are acceptable provided that they are not less than 0.188 in. (4,76 mm) apart.
- (e) Fillet radius shroud and platform.
 - (i) Defects up to 0.010 in. (0,25 mm) diameter are acceptable.
 - (ii) Defects between 0.010 and 0.020 in. (0,25 and 0,51 mm) diameter (dye indication not greater than 0.063 in. (1,59 mm) diameter) are acceptable provided that they are not less than 0.188 in. (4,76 mm) apart.
- (f) Platform surfaces (other than fillet radius).
 - (i) Defects up to 0.010 in. (0,25 mm) diameter are acceptable.
 - (ii) Defects between 0.010 and 0.031 in. (0,25 and 0,79 mm) diameter (dye indication not greater than 0.094 in. (2,38 mm) are acceptable provided that they are not less than 0.188 in. (4,76 mm) apart.
- (q) Blade root.
 - (i) No defects are permitted on the lobe flanks or end surfaces where indicated.
 - (ii) Defects up to 0.010 in. (0,25 mm) diameter (dye indication not greater than 0.031 in. (0,79 mm) diameter) are acceptable in areas other than those in para.(i) provided that they are not less than 0.188 in. (4,76 mm) apart.
 - (iii) Line type defects, either continuous or semi-continuous are not acceptable.

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DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

HP Turbine Blade Blending and Pack Alumizing Details
Figure 402

72-51-03

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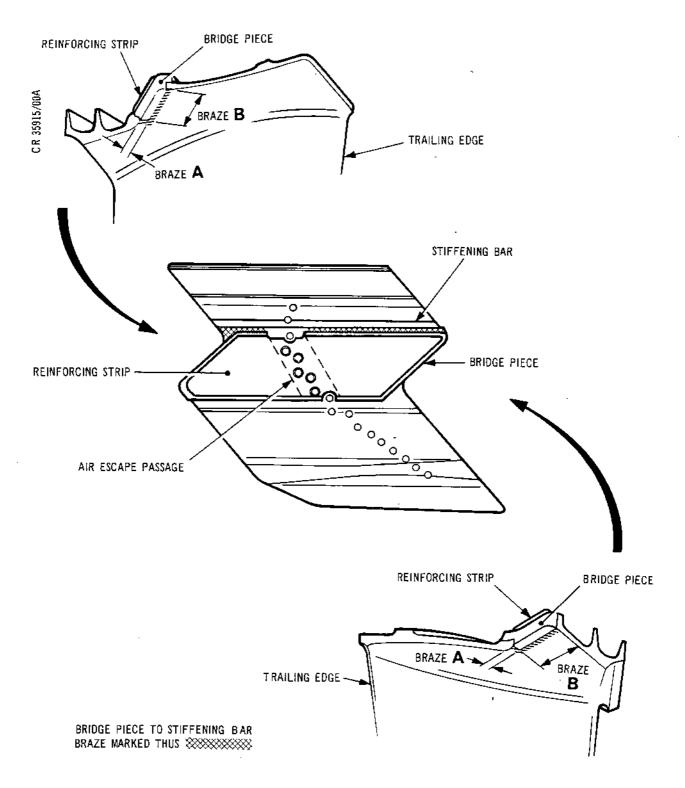
B. Blending Procedure.

- (1) Blend impact damage, thermal fatigue and oxidation/ sulphidation at the leading edge, within the area specified (Ref.Fig.402) and comply with the following conditions:
 - (a) Numerous defects of reasonably close proximity on any blade are to be blended to form one continuous blend (a ripple effect produced by several blends on one blade is undesirable).
 - (b) Remove the minimum amount of material necessary. Blends must be not more than 0.005 in. (0,13 mm) deep.
 - (b) Hand polishing/blending only is permitted on the front face of the blade shroud.
 - (d) Mechanical equipment may be used when blending the blade profile.
 - (e) Blends must be polished to achieve a surface finish of 32 microinches (0,8 micrometres) and radiused as shown in Fig. 402.
 - (f) When blending damage which is less than 0.750 in. (19,05 mm) from the blade platform or shroud, the blend must commence at the end of the blade and the length of the blend must be 0.750 in. (19,05 mm) minimum (Ref.Fig.402).
- (2) Swab etch the blended areas for 10 to 15 seconds in accordance with the procedure detailed in 72-09-14, Repair, using solution F.
- (3) Rinse the blade in hot water and dry it with compressed air.
- (4) Inspect for cracks using the fluorescent dye penetrant process specified for this component in 72-51-03, Inspection/Check.
- (5) Examine the blade with binoculars to confirm complete removal of defects.



- C. Pack Aluminize.
 - (1) Mask the blade root and shroud surfaces with tape and blank cooling holes.
 - (2) Apply the pack aluminizing process to the blade in accordance with the procedure detailed in 72-09-05, Repair. Deposit a coating thickness of 0.001/0.002 in. (0,025/0,050 mm) on the blade aerofoil surfaces and adjacent shroud and platform surfaces marked A and B (Ref.Fig.402).
 - (3) Post aluminizing heat treatment.
 - (a) Diffusion heat treat the blade to between 1090 and 1110 deg C in argon for one hour. Cool to 700 deg C in not more than 8 minutes, in the container.
 - (4) Ensure that all cooling holes in the blade are unobstructed.
 - (5) Inspect the blade using the fluorescent dye penetrant process specified for this component in 72-51-03, Inspection/Check and apply the following acceptance limits in conjunction with Figure 403.
 - NOTE: The acceptance limits quoted are relevant to brazed joints and are to be applied to ensure that the brazing standards required at manufacture have not deteriorated during the repair procedure.
 - (a) Bridge piece to shroud.
 - (i) Cracks are not acceptable.
 - (ii) Sinkage or pitting of braze up to 0.010 in. (0,25 mm) is acceptable on underside of shroud in bridge piece joints marked A and B.
 - (iii) Indication of braze flow out at joints marked A and B is not acceptable.
 - (iv) Presence of braze material in air escape passage is not acceptable.





Inspection of Brazed Joints Figure 403

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Repair No.4
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- (b) Bridge piece to stiffening bar.
 - (i) Up to 10% lack of braze at each of the positions shown is acceptable.
- (c) Reinforcing strip to bridge piece.
 - (i) Cracks are not acceptable.
 - (ii) Up to 10% lack of braze on each of the four sides of the reinforcing strip is acceptable.
- D. Identify.
 - (1) Mark salvage B.499471 or R4 close to the existing part number using the vibro-percussion or electro-chemical marking technique as specified in 72-09-00, Repair.
- E. Finally Inspect.
 - (1) Finally inspect the blade to ensure that the repair has been carried out satisfactorily and that the blade is in a serviceable condition.



<u>HIGH PRESSURE TURBINE BLADE - REPAIR</u> RESTORATION OF WORN SEALING FIN BY WELDING

MODIFICATION NO. OL.8963

1. Effectivity

| I.P.C. | Fig./Item | <u>Part No.</u> |
|----------|-----------|--------------------|
| 72-51-03 | 1 030b | B934172 B934173 |

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the sealing fin of a H.P. Turbine Blade by welding.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority.
- (2) Repair samples should be submitted to the Repair Authority for validation.



3. Instructions

A. Preparation.

CAUTION: TO AVOID WELD CONTAMINATION, ABRASIVE DEVICES CONTAINING ALUMINIUM OXIDES MUST NOT BE USED.

(1) Referring to Fig. 402, use a rotary burn or similar machanical means to remove any rubbed or smeared material from the blade fin.

NOTE: Do not reduce the fin height below the minimum requirement of 0.090 in. (2,29 mm).

(2) Referring to Fig. 402, use a rotary burn or similar mechanical means to remove the pack aluminising coating from the front face and surface oxide deposits from the fin area.

B. Etch.

- (1) Referring to TSD 594-214, locally etch cleaned area using Ferric Chloride for a maximum of five minutes.
- (2) Immediately wash blade with clean, cold water to remove acid. Immerse in clean, hot water, remove and dry.

C. Inspect.

- (1) Visually inspect the etched area for complete removal of the aluminised coating. A uniform light grey grain appearance indicates satisfactory removal. A silver appearance within the etched area indicates aluminising. If aluminising is still present repeat paras.3.A and 3.B. and re-inspect.
- (2) Carry out the fluorescent dye penetrant check specified for this component in Chapter 72-51-03, Inspect/Check.

D. Clean.

- (1) Thoroughly clean the fin using a rotary stainless steel brush.
- (2) Immediately prior to welding, swab the repair area fluid OMat 1/21A.

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E. Weld.

(1) Referring to TSD-409 and using OMat 312 (MSRR 9500/4), weld build up the fin to restore full fin height.

NOTE: If more than one weld deposit is required, ensure previous deposits are cleaned and degreased as detailed at paras.D. (1) and D. (2), prior to application of the next layer of weld.

F. Inspect.

- (1) Locally inspect the welded fin for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-03, Inspect/Check.
- G. Heat Treat.
 - (1) Heat the blade in a vacuum furnace to $850_{\rm O}{\rm C}$ plus/minus $10_{\rm O}{\rm C}$ for two hours.
 - (2) Rapid gas quench.
- H. Inspect.
 - (1) Locally inspect the blade using the fluorescent dye penetrant process specified for this component in Chapter 72-51-03, Inspect/Check.
- J. Machine.
 - NOTE: Machining may be carried out simultaneously on batches of similarly repaired H.P. turbine blades.
 - (1) Referring to Figs. 401 and 402, position welded blades in holding fixture Part No. S3S 90571000 and set true on milling machine.
 - (2) Machine blades to final dimensions (Ref. Figs. 401 and 402).

K. Etch.

(1) Referring to Chapter 72-09-14, Repair, swab etch the machined fin for a maximum of two minutes using Solution F.

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- L. Inspect.
 - (1) Locally inspect the repaired area for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-03, Inspect/Check.
- M. Identify.
 - (1) Mark on SAL B513482 adjacent to the existing part number using vibro-percussion marking as specified in Chapter 72-09-00, Repair.
- 4. Special Tools, Fixtures and Equipment

Part Number

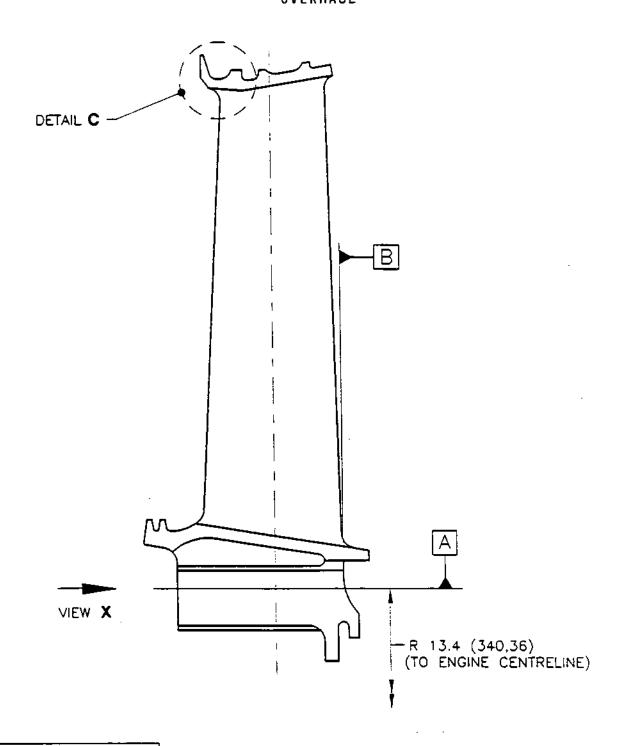
Description

S3S 90571000

fixture, Holding

5. Replacement Parts

None.



DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

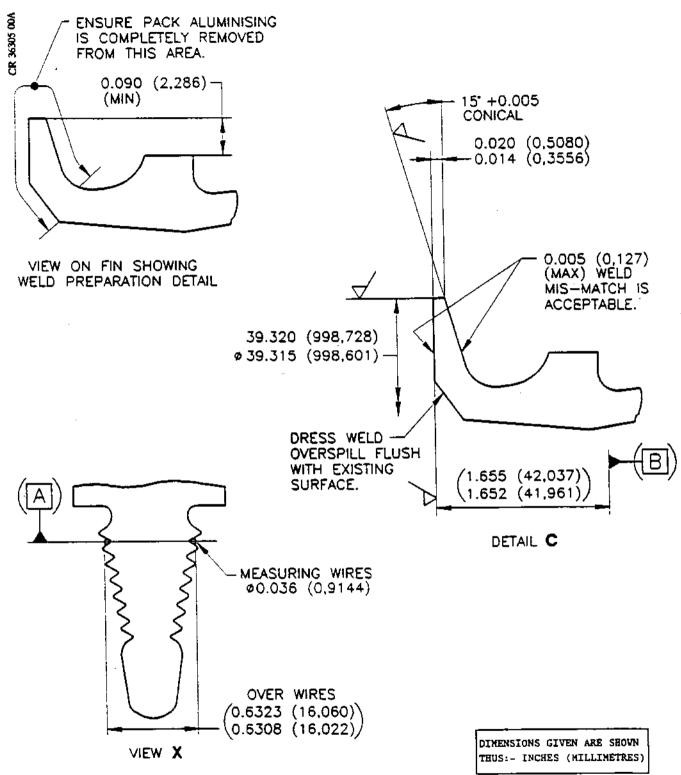
> Turbine Blade Machining Set-up Figure 401

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Turbine Blade Machining Detail Figure 402

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BLADE, ASSEMBLY OF, TURBINE, HP

BLENDING OF DAMAGED AND/OR CRACKED SHROUD SEAL FIN

REPAIR NO. B513483

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|--|--|
| 72-51-03 | 01 030 01 030 01 030 01 030 01 030 01 030 01 030 | B926522 B927089 B927281 B927342 B930408 B930865 B931334 B934172 |
| | UT U30 | 57341(4 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Any one of the shroud fins may be blended to this Repair Instruction.

The maximum length of blending is 0.350(8,89).

The maximum depth of blending is 0.075(1,91).

A maximum of five blades (blended to this Repair Instruction) may be installed in any one H.P.T. Module.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR 72-51-03 Repair No.6 Page 401 Dec 1/91



4. REPAIR PROCEDURE

REPAIR PROCEDURE

- Inspect to re-identify extent of damage and/or cracking (if required).
- 2) Using conventional hand tools only, blend to remove damage and/ or crack(s). Remove minimum material, producing a smooth and continuous profile.
- Inspect for removal of damage and/or cracking.
- 4) Dimensionally inspect to ensure repair limitations have not been exceeded.
- 5) Mark SAL.B513483 or R6 adjacent to existing part number, using vibro-percussion engraving.

5. MATERIAL

COMPONENT.

BLADE, ASSEMBLY OF,

TURBINE H.P.

6. DATA

6. TOOLS

NONE.

NONE.

8 REPLACEMENT PARTS

NONE.

SUPPLEMENTARY INFORMATION

Refer Overhaul Manual Chapter 72-51-03 Inspection/Check.

Refer fig.401 Refer Overhaul Manual Chapter 72-09-22 Repair.

Refer Overhaul Manual Chapter 72-51-03. Inspection/Check.

Refer fig. 401

Refer Overhaul Manual Chapter 72-09-00 Repair.

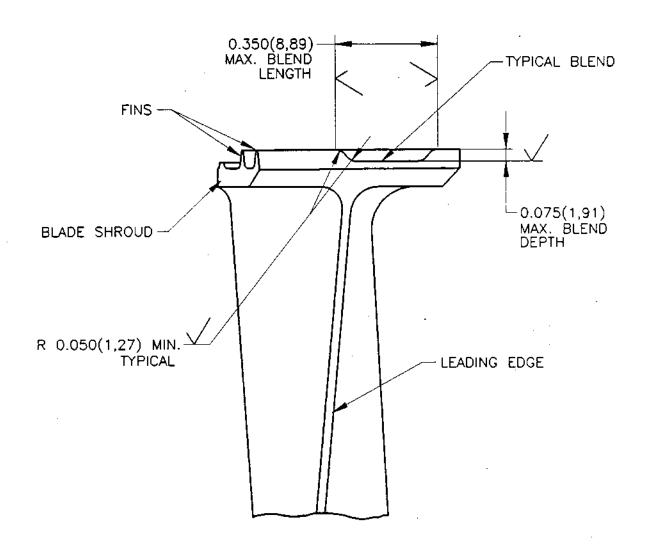
RR CODE.

NIMONIC IN100 MSRR 7047.

MATERIAL.

QEA

REPAIR 72-51-03 Repair No.6 Page 402 Dec 30/98



DIAGRAMMATIC VIEW ON BLADE OUTER SHROUD FINS FIG.401



DISK, TURBINE ROTOR, HP - REMOVAL OF FLANK FACE FRETTING FROM HIRTH SERRATION COUPLINGS BY GRINDING

REPAIR NO. B516017

1. EFFECTIVITY

| I.P.C. | Fig./Item | <u>Part No.</u> |
|----------|-----------|-----------------|
| 72-51-03 | 1/70A | B903094 |
| | 1/70A | B925342 |
| | 1/70A | B925348 |
| | 1/70A | B929375 |
| | 1/70A | B929399 |
| | 1/70B | B925894 |
| | 1/70c | B931838 |
| | 1/70c | B931840 |
| | 1/70c | B931841 |
| | 1/70C | В931849 |
| | 1/70C | B931854 |
| | 1/70C | B931855 |
| | 1/700 | B931802 |
| | 1/70D | B931805 |
| | 1/70b | B931808 |
| | 1/70D | B931810 |
| | 1/70D | B931816 |
| | 1/70D | B931817 |
| | 1/70b | B933165 |
| | 1/700 | B933178 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this Repair Process shall be achieved without deviation. Where a need to deviate is considered necessary reference shall be made to the Repair Authority for agreement.

This instruction gives the procedure for removal of flank face fretting from hirth serration couplings by grinding on the Disk, Turbine Rotor, HP.

A test sample is required for validation purposes prior to the initial repair and any subsequent change of process, sub-contractor or locality. Details of the validation test requirements should be obtained by writing to the repair authority at Rolls-Royce Plc.

72-51-03



All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

Where turning is used and cut is less than 0.005 (0,125) particular attention must be paid, on inspection, to cracking along grain boundaries or along twins in the grains themselves.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. Clean the Part
- 1) Locally remove the grease.

Refer to TASK 70-00-00-100-101 or TASK 70-00-00-100-102. Use degreasing equipment.

- B. Penetrant Crack Test
- Do a penetrant crack test on the part.

Refer to TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-001. Use OMat 651 Fluorescent penetrant High sensitivity post-emulsified. Cracks are not permitted. Use penetrant crack test equipment.



- C. Machine the Part
- Install the part in the turning fixture.

Use the CJ1127107 Holding Fixture 1 off.

2) Turn the front (top) face of hirth serrations to the applicable dimension. Use a lathe. Refer to Para.6 - DATA. Refer to Figs.401, 402 and 405.

- D. Machine the Part
- Install the part in the milling fixture.

Use the CJ1127107 Holding Fixture 1 off.
Use the CJ1355856 Alignment Bar 1 off.
Use the CJ1367141 Location Peg 1 off.
Use the CT1161118 Cutter 1 off.

Mill the root radius of hirth serrations to the applicable dimension. Use a milling machine. Refer to Para.6 - DATA. Refer to Figs.401 and 404.

- E. Machine the Part
- Install the part in the grinding fixture.

Use the CJ1127107 Holding Fixture 1 off.
Use the CJ1355856 Alignment Bar 1 off.
Use the CJ1367141 Location Peg 1 off.
Use the CT1159473 Diamond Roller 1 off.
Use the CG1357117 Blueing Gauge 1 off.

Grind the flank faces of hirth serrations to the applicable dimension. Use a grinding machine. Refer to Para.6 - DATA. Refer to Figs.401 to 404 and 406.



F. <u>De-burr</u>

 Remove the burrs and sharp edges and produce corner radii as required. Use standard hand tools. Refer to Figs. 402 to 404 and 407.

- G. Examine the Part
- Do a visual inspection of the part.

Ensure removal of all fretting.

- H. Clean the Part
- 1) Remove the grease.

Refer to TASK 70-00-00-100-101 or TASK 70-00-00-100-102. Use degreasing equipment.

- J. Etch the Repaired Area
- Do a swab etch of the repaired area.

Refer to TASK 70-00-00-200-214 SUBTASK 70-00-00-110-214-A01.

- K. Penetrant Crack Test
- Do a penetrant crack test on the repair area.

Refer to TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002. Use OMat 651 Fluorescent penetrant High sensitivity post-emulsified. Cracks are not permitted. Use penetrant crack test equipment. Refer to General Data, specifically warning of twinning.

- L. Vapour Blast the Part
- Mask the areas not to be vapour blasted.

Refer to TASK 70-00-00-300-338. Ensure masking is applied to allow blasting fade-out around repaired areas.

REPAIR

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2) Set up blasting parameters.

Refer to TASK 70-00-00-300-338. Set up blasting machine to achieve an ALMEN intensity of 2N Min. and coverage of 200 percent. Use OMat 1/244 Abrasive medium. Use vapour blasting equipment.

3) Vapour blast the repaired areas.

Vapour blast the areas using the parameters obtained in Para.L. 2).

THE FOLLOWING OPERATION IS NOT REQUIRED FOR HP TURBINE DISK PART NUMBERED B903094.

M. <u>Shot peen the Part</u>

 Mask the areas not to be shot peened. Refer to TASK 70-00-00-300-338. Ensure masking is applied to allow peening fade-out around repaired areas.

2) Set up peening parameters.

Refer to TASK 70-00-00-300-338. Set up the shot peening machine to achieve an ALMEN intensity of 4A to 8A and coverage of 200 percent. Use OMat 1/28 Metallic shot (Cast steel). Use shot peening equipment.

Shot peen the repaired areas.

Shot peen the areas using the parameters obtained above.

N. Check Balancing

Recheck static balance off serrations.

Final unbalance 200 Drm.In.

P. Identify the Repair

 Mark on B516017 or R7 adjacent to the part number. Refer to Overhaul Manual Chapter 72-09-00 Repair. Use vibration peen equipment. Refer to Fig. 401.

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5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u> <u>RR CODE</u>

DISK, TURBINE ROTOR WASPALOY QDY

HР

6. DATA

Cutting Rates:

| MACHINE PROCESS | SPINDLE SPEED | FEED RATE | COOLANT |
|--------------------|------------------|-------------------|-------------|
| TURNING . | 10.7 RPM | 0.002(0,06)/REV | css127 1:30 |
| MILLING | 39 RPM | 0.236(6,00)/MIN | css127 1:30 |
| GRINDING | 3500 RPM | 3.937(100,00)/MIN | css127 1:30 |

7. <u>TOOLS</u>

| TOOL NUMBER DESCRIPTION | | QTY |
|-------------------------|-----------------|-----|
| ¢G1357117 | Blueing Gauge | 1 |
| CJ1127107 | Holding Fixture | 1 |
| CJ1355856 | Alignment Bar | 1 |
| CJ1367141 | Location Peg | 1 |
| CT1159473 | Diamond Roller | 1 |
| CT1161118 | Cutter | 1 |

8. REPLACEMENT PARTS

NONE.



9. STANDARD EQUIPMENT

Degreasing equipment
Grinding machine
Lathe
Milling machine
Penetrant crack test equipment
Shot peening equipment
Use standard hand tools
Vapour blasting equipment
Vibration peen equipment

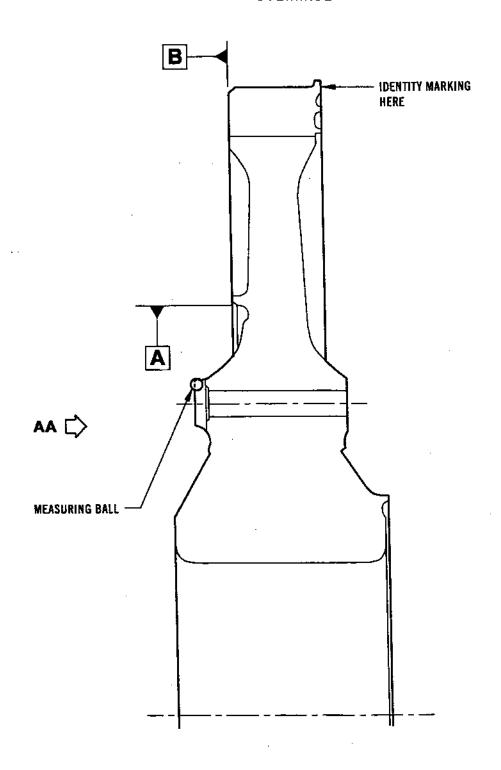
10. CONSUMABLE MATERIAL

OMat 1/244 Abrasive medium
OMat 1/28 Metallic shot (cast steel)
OMat 651 Fluorescent penetrant high sensitivity postemulsified

- NOTE: 1. To identify the consumable materials refer to the Overhaul Materials Manual (OMat).
 - 2. Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

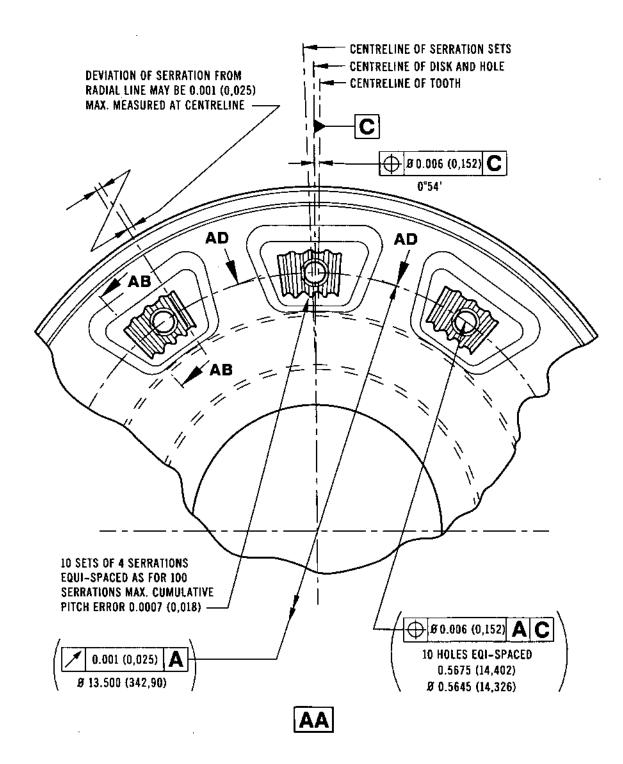
11. EXPENDABLE PARTS

NONE.



Typical Section Through HP Turbine Disk Figure 401

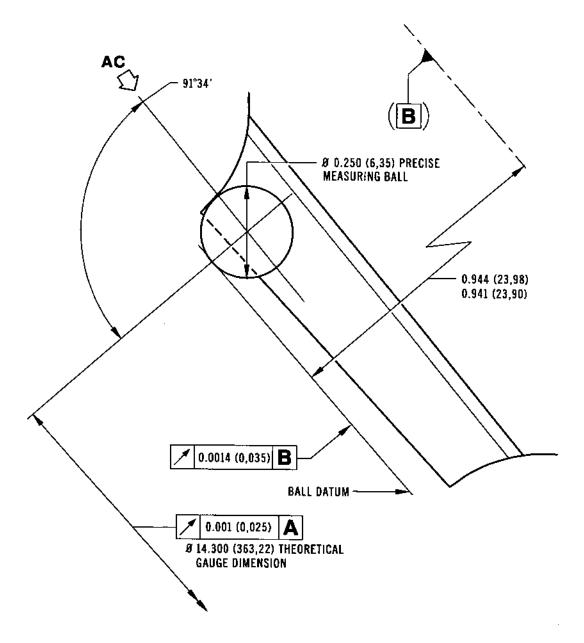
REPAIR 72-51-03 Repair No.7 Page 408 Jun 30/00 BS00028161/1



HP Turbine Disk - Details Figure 402

> REPAIR 72-51-03 Repair No.7 Page 409 Jun 30/00

BS00028164/1

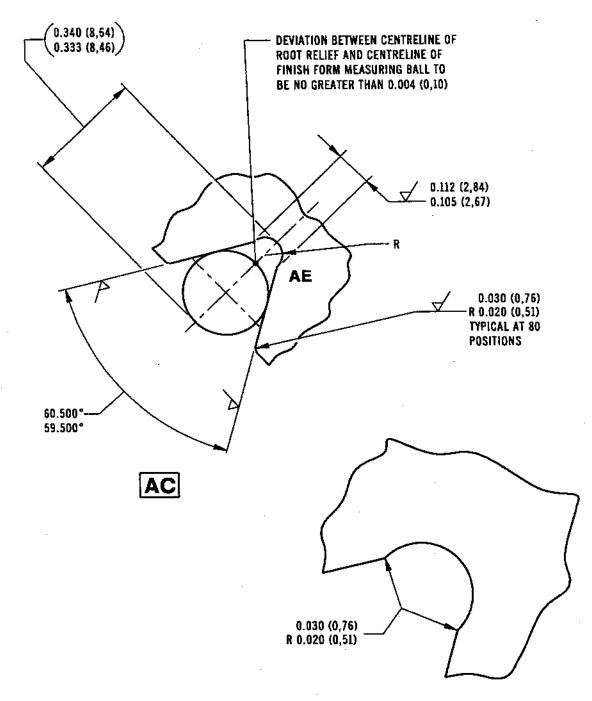


SECTION AB

HP Turbine Disk - Details Figure 403

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BS00028165/1



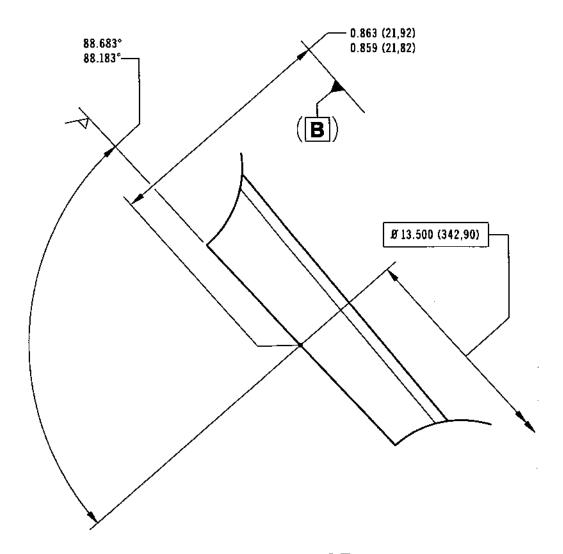
DETAIL AE

HP Turbine Disk - Details Figure 404

REPAIR

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BS00028166/1



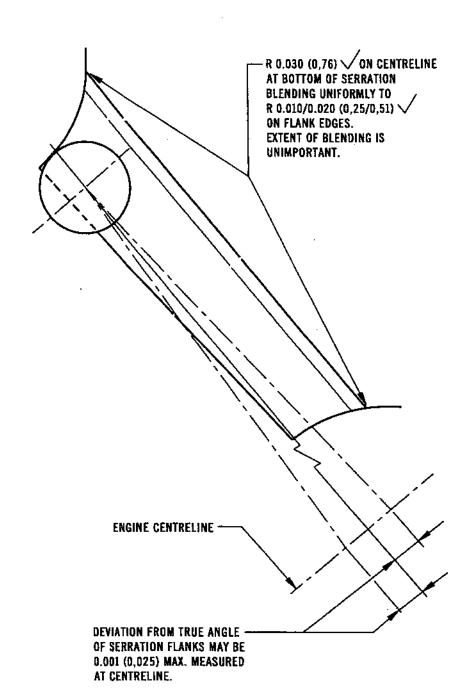
REPEAT SECTION AB SHOWING MACHINING OF TOP OF HIRTH SERRATION

HP Turbine Disk - Details Figure 405

> REPAIR 72-51-03 Repair No.7 Page 412

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BS00028167/1

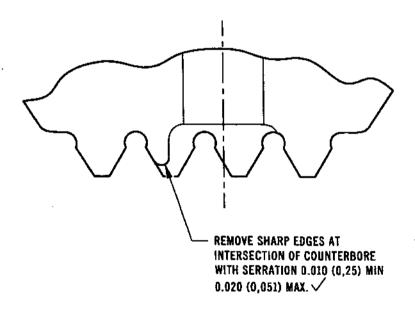


REPEAT SECTION AB

HP Turbine Disk - Details Figure 406

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SECTION AD

HP Turbine Disk - Details Figure 407

> REPAIR 72-51-03 Repair No.7 Page 414 Jun 30/00



HP TURBINE ROTOR - HUB AND LABYRINTH ASSEMBLIES - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|-----------|------------|--|------------------------------------|
| n England | 1 | Labyrinth Ring Fins Repaired by Roll Forming | SAL.B.478105 |
| | 2 . | Labyrinth Ring Fins Repaired by Roll Forming | SAL.B.478108-10 |
| ted in | 3 | First Stage Hub Labyrinth Fins Repaired by Roll Forming | SAL.B.478098-104 |
| Printed | 4 | <pre>HP Turbine Labyrinth Seal Ring - Restoration of Labyrinth Fins by Plasma or TIG Welding</pre> | SAL.B.488620-22 SAL.B.512815-17 |
| | 5 | Repair of No.23 Labyrinth Fins by Plasma Welding | SAL.B.488593 |
| | 6 | Restoration of Labyrinth Fins by TIG Welding | SAL.B.488632-8 |
| | . 7 | Restoration of No.24 and 26 Labyrinth Seal Outside Location Diameter by Plasma Spray | SAL.B.513490 |



HP TURBINE ROTOR - HUB AND LABYRINTH ASSEMBLIES - REPAIR

MODIFICATION NO. 01.7507c, 01.8429c, 01.8807c

Effectivity

| I.P.C. | Fig./Item | <u>Part No.</u> |
|----------|-----------|----------------------|
| 72-51-04 | 1 250A | B.919008 |
| | 250B | B.919958 B.929435 |

1. Introduction

- A. This Repair describes the procedures for restoring defective fins on the labyrinth rings, in order to maintain the standard fin/housing clearances of labyrinth No.23. The diameter of each fin is first increased by roll forming then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the roll forming technique applicable to this repair procedure.
- C. Dimensions are shown thus on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. Fins which have previously been repaired by welding must not be restored by roll forming.
- B. The first repair to each Labyrinth ring must be carried out in accordance with paragraph 3. Subsequent repairs must be carried out in accordance with paragraphs 3 and 4.
- C. Verify that there is adequate material at each defective location to permit machining to the dimension before roll forming (Ref.para.3 and 4).

3. Summary of Operations

- A. Locate the labyrinth ring in fixture (Item 5) and set true in centre-lathe on datum diameter A (Fig. 401).
- B. Clean up defective fins; remove only the minimum amount of material to achieve the specified dimension (Ref.Fig.402). A localised "witness", not exceeding 0.003 in. (0,076 mm) in depth, is acceptable.

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- C. Carefully remove any burrs.
- D. Apply the roll forming technique to increase the diameter of defective fins to the roll forming dimensions (Ref.Fig.403 and 404).

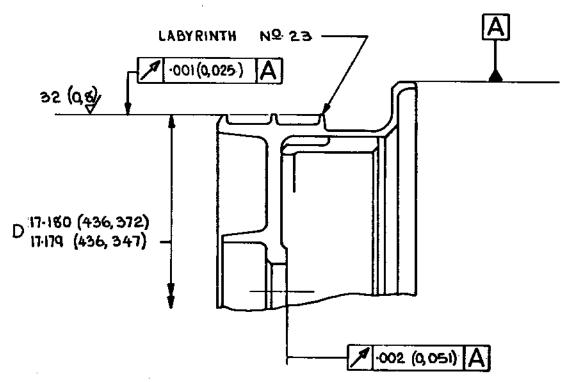
NOTE: Use one roller (item 6) with one roller (item 3) when rolling end fin (VIEW AT AC).

- E. Remove any folds by careful blending (Ref.Fig.403).
- F. Crack test the labyrinth ring by the process specified for this component in 72-51-03, Inspection/Check.
- G. Finish machine the fins to the specified dimensions (Ref.Fig.401); a maximum of 1.000 in. (25,4 mm) of the circumference which has not cleaned up is acceptable on each fin.
- H. Polish fins to remove sharp edges.
- J. Chemically etch the labyrinth ring using solution C and etching technique, (Ref. 72-09-14 Repair), and repeat the test for cracks (para.f.).
- K. Vapour blast the labyrinth ring; use alumina, garnet or quartz grit mesh 320/400.
- L. Identify repair. Mark the repair scheme number SAL 8.478105 close to the standard part number on the component. For the second repair, mark /2 against the existing repair scheme number.

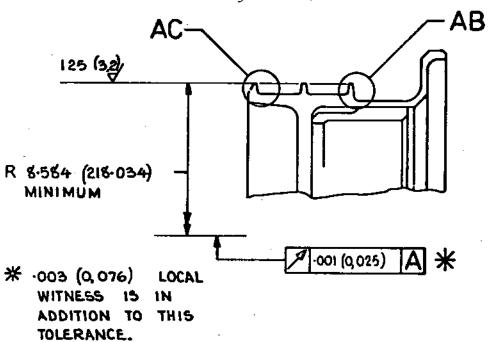
4. <u>Amended Dimensions for Repeated Rolling of No.23</u> Labyrinth Fins

- A. Machining dimension before roll forming (Ref.Fig.402) may be reduced to 8.5815 in. (217,970 mm) minimum, if necessary.
- B. Roll forming radius (Ref.Fig.403 and 404) may be reduced to 8.5905 in. (218,199 mm) minimum, if necessary.
- C. Standard dimension (Ref.Fig.401) may be reduced to 17.175 in. (436,245 mm) minimum, if necessary.





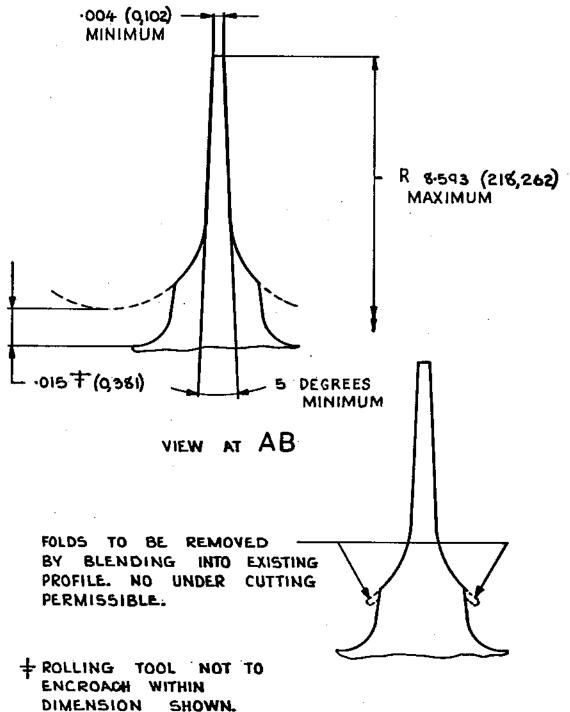
Standard Dimensions Figure 401



Machining Dimensions Before Roll Forming Figure 402

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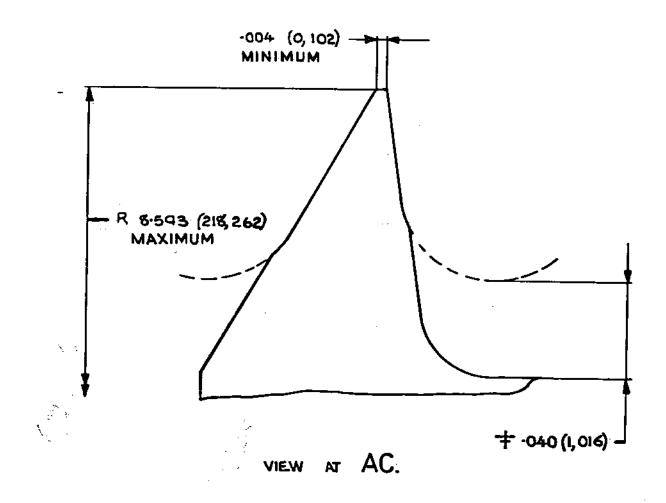




Roll Forming Dimensions and Fold Blending Detail Figure 403

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Roll Forming Dimensions Figure 404

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5. Special Tools, Fixtures and Equipment

| Description | <u>Quantity</u> | Tool No. | <u>Item</u> |
|--------------|-----------------|-------------------|-------------|
| Tool Holder | 1 | S3S.12358000 | 1 |
| Rolling Tool | 1 | s3s.12363000 | 2 |
| Roller | 2 | \$35.12381000 | 3 |
| Shims | 4 | \$3\$.12375-78000 | 4 |
| Fixture | ` 1 | s3s.12422000 | 5 |
| Roller | 1 | s3s.2371000 | 6 |

Replacement Parts

A. Not required.



HP TURBINE ROTOR - HUB AND LABYRINTH ASSEMBLIES - REPAIR

Applicable to:

Labyrinth Rings B.918604 and B.925413

Authority:

Modification No. OL. 7507C

1. Introduction

- A. This Repair describes the procedure for restoring defective fins on the labyrinth ring, in order to maintain the standard fin/housing clearances of labyrinth No.24 and No.26. The diameter of each fin is first increased by roll forming then finish machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the roll forming technique applicable to this repair procedure.
- C. Dimensions are shown thus in Table 401 and on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. This Repair may be applied once only.
- B. Fins which have previously been repaired by welding must not be restored by roll forming.
- C. Verify that there is adequate material at each defective location to permit machining to the dimensions before roll forming (Ref.para.3.A.).

Summary of Operations

- A. Locate the labyrinth ring in fixture (Item 1) and set true in external grinder on datum bore A (Ref.Fig. 401).
- B. Clean up defective fins; remove only the minimum amount of material to achieve the specified dimensions (Ref.Fig.402). A localised "witness", not exceeding 0.003 in. (0,076 mm) in depth, is acceptable.
- C. Carefully remove any burrs.

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Repair No.2
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D. Apply the roll forming technique to increase the diameter of defective fins to the roll forming dimensions (Ref. Table 401 and Fig. 403 and 404).

NOTE: Use one roller (item 4) with one roller (item 5) when rolling end fin (VIEW AT AD)

- E. Remove any folds by careful blending (Ref.Fig.403).
- F. Crack test the labyrinth ring by the process specified for this component in 72-51-03, Inspection/Check.
- G. Finish machine the fins to the specified dimensions (Ref.Fig.401); a maximum of 1.000 in. (25,4 mm) of the circumference which has not cleaned up is acceptable on each fin.
- H. Polish fins to remove sharp edges.
- J. Chemically etch the labyrinth ring using solution C and etching technique, (Ref. 72-09-14 Repair), and repeat the test for cracks (para.F.).
- K. Vapour blast the labyrinth ring; use alumina, garnet or quartz grit mesh 320/400.
- L. Identify repair (Ref. Table 401). Mark the appropriate repair scheme number close to the standard part number on the component.

| | REPAIR SCHEME NUMBER | VIEW AT (REF | RADIUS FIGURE 403 | | MUM RADII 1) |
|-----|----------------------------|-----------------|----------------------|-------|-----------------|
| SAL | в.478108 | AC and AD | G and K | 8,208 | (208, 483) |
| SAL | B.478109 | AE | Н. | 3.496 | (88,798) |
| SAL | B.478110 | AF | J | 2.956 | (75,082) |

Roll Forming Dimensions Table 401



4. Special Tools, Fixtures and Equipment

| Description | Quantity | Tool No. | <u>Item</u> |
|---|------------------|---|----------------------------|
| Fixture Tool Holder Rolling Tool Roller Roller Shims | 1 1 1 2 | \$3\$.12423000 \$3\$.12358000 \$3\$.12363000 \$3\$.12374000 \$3\$.12382000 \$3\$.12375-78000 | 1 2 3 4 5 6 |

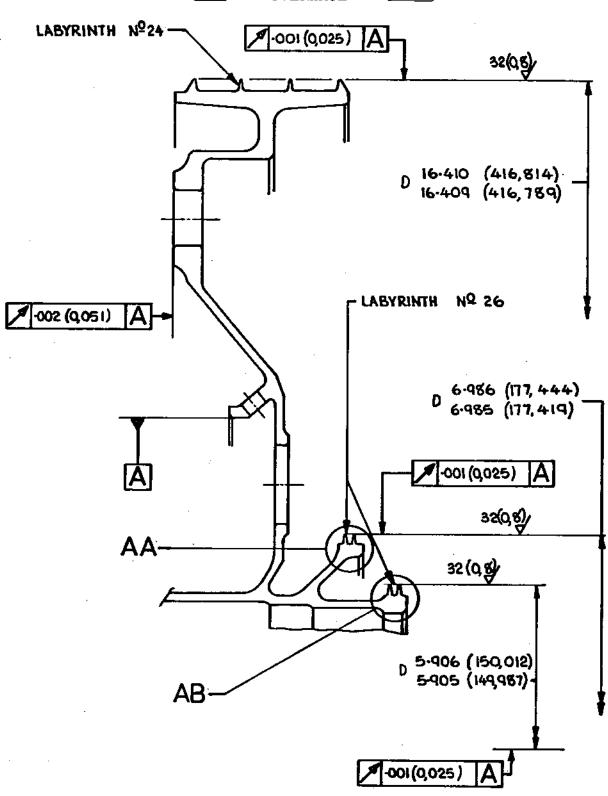
Replacement Parts

A. Not required.

72-51-04

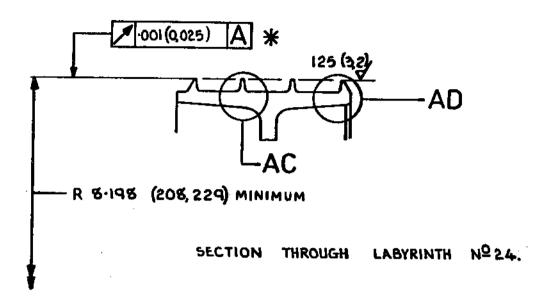
Repair No.2 Page 403 Oct 1/76

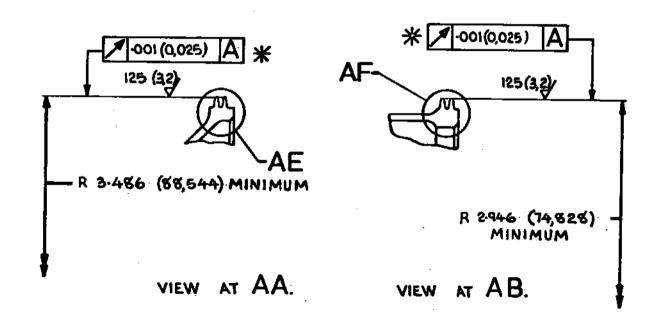




Standard Dimensions Figure 401

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¥ -003 (0,076) LOCAL WITNESS IS IN ADDITION TO THESE TOLERANCES.

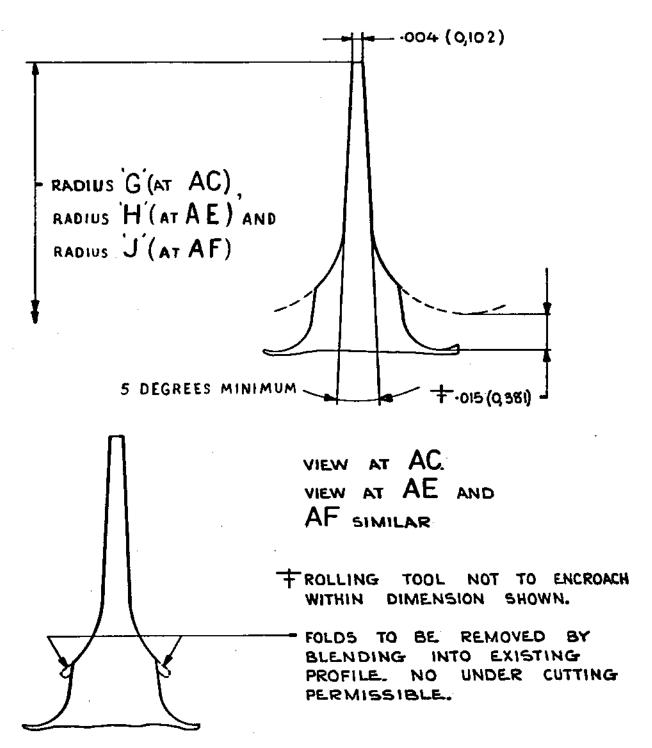
Machining Dimensions Before Roll Forming Figure 402

REPAIR

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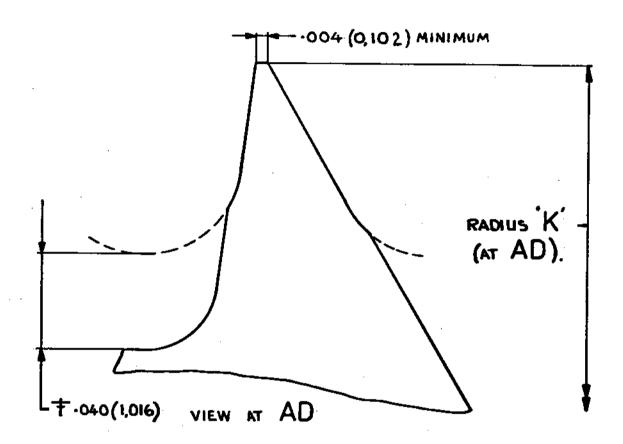




Roll Forming Dimensions and Fold Blending Detail Figure 403

REPAIR

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Roll Forming Dimensions Figure 404

RFPAIR

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HP TURBINE ROTOR - HUB AND LABYRINTH ASSEMBLIES - REPAIR

MODIFICATION NO. OL.8327C, OL.8807C

<u>Effectivity</u>

| I.P.C. | <u>Fig_/Item</u> | <u>Part No.</u> |
|----------|------------------|----------------------|
| 72-51-04 | 1 300A | B.439926 B.922102 |

1. Introduction

- A. This Repair describes the procedure for restoring defective labyrinth fins on the HP turbine rotor first stage hub, in order to maintain the standard fin/housing clearances of labyrinth No.16, No.17, No.18, No.19, No.20, No.21 and No.22. The diameter of each fin is first increased by roll forming then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the roll forming technique applicable to this repair procedure.
- C. Dimensions are shown thus in Table 401 and on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. Fins which have previously been repaired by welding must not be restored by roll forming.
- B. The first repair to each HP turbine hub assemby must be carried out in accordance with paragraph 3. Subsequent repairs must be carried out in accordance with paragraphs 3 and 4.
- C. Verify that there is adequate material at each defective location to permit machining to the dimensions before roll forming (Ref.para.3 and 4).

3. Summary of Operations

- A. Secure the hub to the centre-lathe faceplate and set true on datum bore A (Ref.Fig.401).
- B. Clean up defective fins; remove only the minimum amount of material to achieve the specified dimensions (Ref. Fig. 402). A localised "witness", not exceeding 0.003 in. (0.076 mm) in depth, is acceptable on each fin.

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- C. Carefully remove any burrs.
- D. Apply the roll forming technique to increase the diameter of defective fins to the specified dimensions (Ref. Table 401 and Fig. 403).
- E. Remove any folds by careful blending (Ref.Fig. 403).
- F. Crack test the hub with fluorescent penetrant.
- G. Finish machine the fins (Ref_Fig_401); a maximum of 1.000 in. (25,4 mm) of the circumference which has not cleaned up is acceptable on each fin.
- H. Polish fins to remove sharp edges.
- J. Chemically etch the hub using solution C and etching technique, (Ref. 72-09-14 Repair) and repeat the test for cracks (Ref. para.F.).
- K. Vapour blast the hub; use grit mesh 280/500.
- L. Identify repair (Ref. Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the rotor hub. For the second repair, mark /2 against the existing repair scheme number.

| REPAIR SCHEME NO. | VIEW AT | RADIUS (REF | MAXIMUM RADII _FIG_403) |
|----------------------|---------|----------------|----------------------------|
| SAL B.478098 | AA | н | 3.703 (94,056) |
| SAL B.478099 | AB | J | 3.903 (99,136) |
| SAL B.478100 | AC | K | 4.153 (105,486) |
| SAL B.478101 | AD | L | 4.603 (116,912) |
| SAL B.478102 | AE | M | 5.083 (129,108) |
| SAL B.478103 | AF | N | 5.563 (141,300) |
| SAL B.478104 | AG | P | 6.043 (153,492) |

Roll Forming Dimensions Table 401



MK.610-14-28 snecma
OVERHAUL

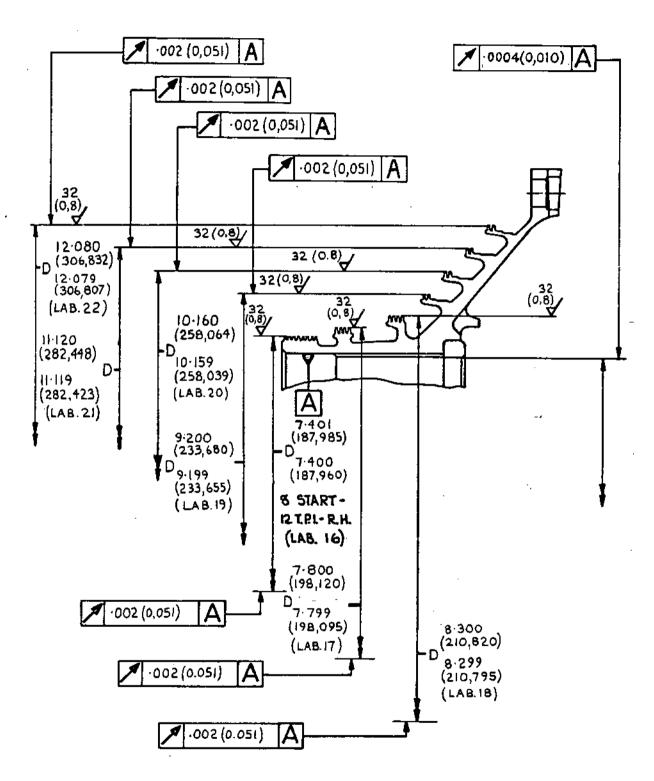
4. <u>Amended Dimensions for Repeated Rolling of No.16 to 22</u> <u>Labyrinth Fins</u>

- A. Dimensions before roll forming (Ref.Fig.402) may be reduced if necessary, as follows:
 - (1) View at AA radius reducedby 0.001 in. (0,025 mm).
 - (2) Views at AB, AC, AD, AE, AF and AG \neg radii reduced by 0.0025 in. (0,0635 mm).
- B. Roll forming dimensions (Ref.Fig.403 and Table 401) may be reduced, if necessary, as follows:
 - (1) View at AA radius reduced by 0.001 in. (0.025 mm).
 - (2) Views at AB, AC, AD, AE, AF and AG radii reduced by 0.0025 in. (0,0635 mm).
- C. Standard dimensions (Ref.Fig.401) may be reduced, if necessary, as follows:

| | | | | |
|---------------------|-------------|------------------|--------|-------------------|
| LABYRINTH NUMBER | | NDARD UM DIA. | | OUCED NUM DIA. |
| 16 | 7.400 | (187,960) | 7.398 | (187,909) |
| 17 | 7.799 | (198,095) | 7.793 | (197,942) |
| 18 | 8.299 | (210,795) | 8.293 | (210,642) |
| 19 | 9.199 | (233,655) | 9.194 | (233,528) |
| 20 | 10.159 | (258,039) | 10.154 | (257,91) |
| 21 | 11.119 | (282,423) | 11.114 | (282,296) |
| 22 | 12.079 | (306,807) | 12.074 | (306,680) |
| | | | | |

Table 402

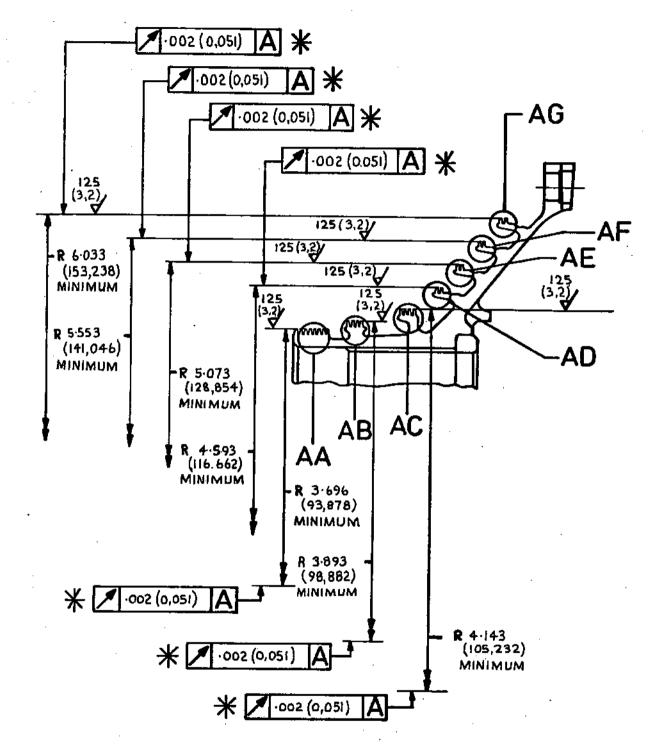




Standard Dimensions Figure 401

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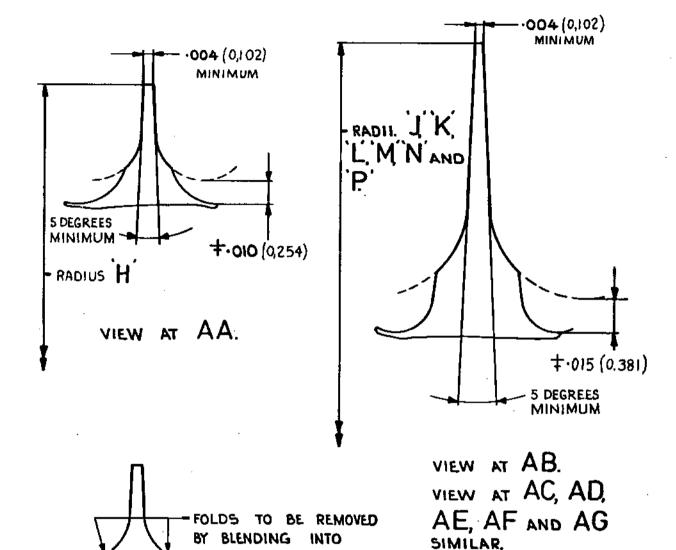




** 003 (0,076) LOCAL WITNESS IS IN ADDITION TO THESE TOLERANCES.

Dimensions Before Roll Forming Figure 402

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T ROLLING TOOL NOT TO ENCROACH WITHIN DIMENSION SHOWN.

PROFILE.

NO UNDER CUTTING

PERMISSIBLE.

EXISTING

Roll Forming Dimensions and Fold Blending Detail Figure 403

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5. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | <u>Tool No.</u> | <u>Item</u> |
|--------------------|-----------------|-----------------|-------------|
| Tool Holder | 1 | s3s.12358000 | 1 |
| Rolling Tool | 1 | 838.12363000 | 2 |
| Roller | 2 | S3S.12380000 | 3 |
| Roller | 2 | s3s.12382000 | 4 |
| Shims | 4 | S3S.12375-78000 | 5 |

- A. SAL.B.478098. Use items 1, 2, 4 and 5.
- B. SAL.B.478099-104. Use items 1, 2, 3 and 5.
- 6. Replacement Parts
 - A. Not required.



HP TURBINE LABYRINTH SEAL RING - RESTORATION OF LABYRINTH FINS BY PLASMA OR TIG WELDING

MODIFICATION NO. OL.8807C, OL.8941C

1. Effectivity

| I.P.C. | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|----------------------|
| 72-51-04 | 1 160 | B.918604 B.925413 |

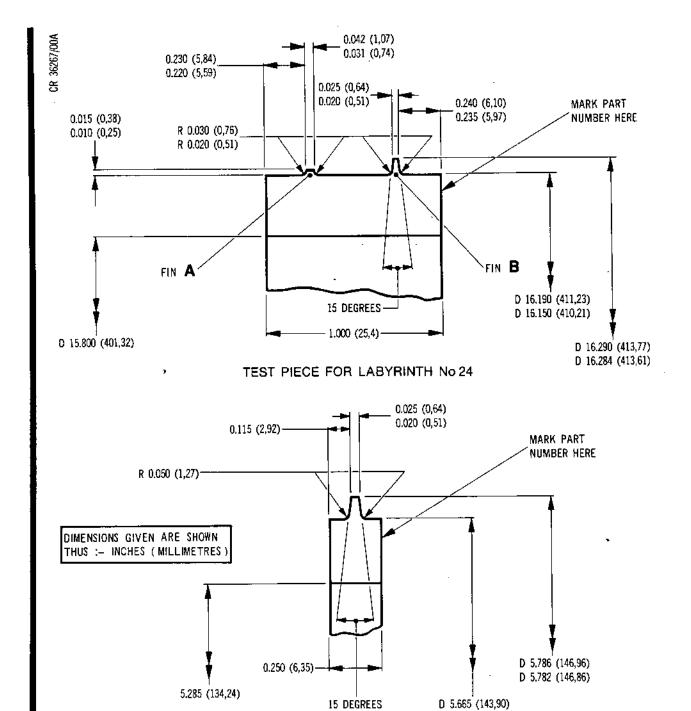
2. Introduction

A. General.

- (1) This repair describes the procedure to be followed in order to restore the fins of labyrinths No.24, 26A and 26B to a serviceable condition after they have become worn or damaged.
- (2) Refer to 72-09-00, Repair for all standard practices applicable to this repair procedure.
- (3) Prior to commencing weld build-up repair work on labyrinth seal ring assemblies, a test piece having the same geometry as the standard component must be prepared and then metallurgically examined. A new test piece will be required upon any change of airline operator, sub-contractor, machine or welding equipment involved with the repair of labyrinths to the requirements of this procedure. A standard component may be used as a test piece.
- (4) Remove burrs and sharp edges 0.004 in. to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 63 microinches (1,6 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in this procedure are detailed in paragraph 5.

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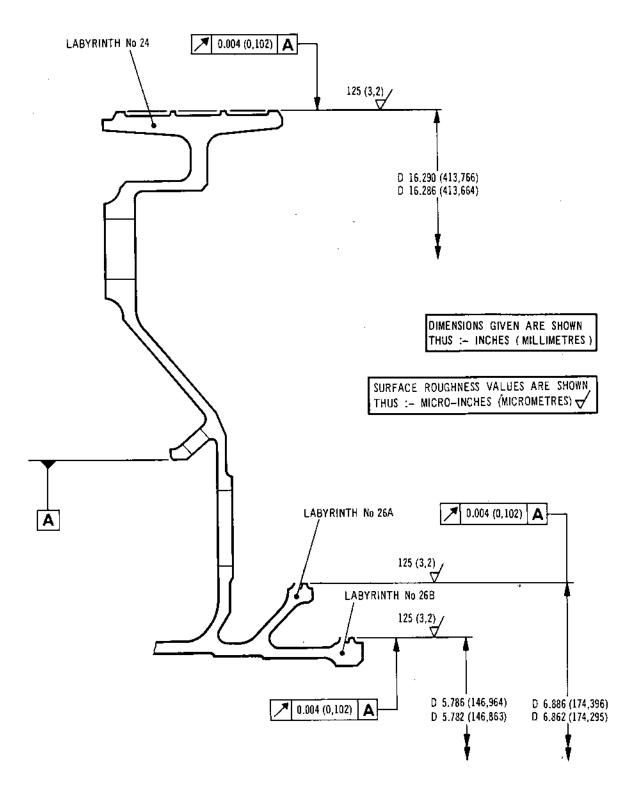




TEST PIECE FOR LABYRINTH No's 26A AND 26B

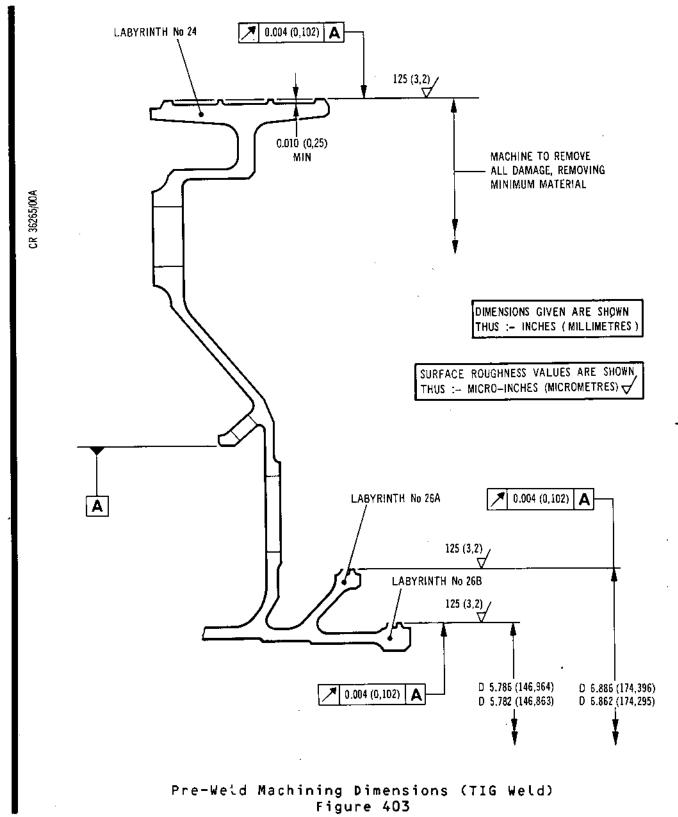
Test Piece Manufacturing Details Figure 401

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Pre-Weld Machining Dimensions (Plasma Weld) Figure 402

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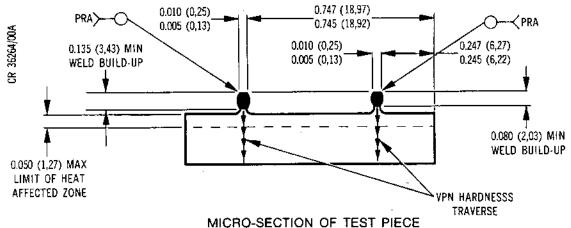
72-51-04
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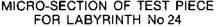


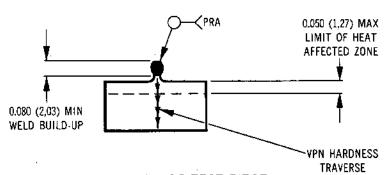
3. Preparation and Use of Test Piece

- A. Machine Test Piece.
 - (1) Produce test pieces in fully heat treated MSRR 7034 material to the dimensions shown in Fig.401 to simulate labyrinth numbers 24, 26A and 26B. Alternatively, an unserviceable standard labyrinth seal ring assembly machined to the dimensions shown in Figure 402 or 403 as appropriate, may be used as a test piece. If an unserviceable standard labyrinth seal ring is to be used, carry out the machining with the component installed in the holding fixture (Ref. tool item 1).
- B. Build-Up Fins on Test Piece.
 - (1) Use the plasma welding technique detailed in 72-09-12 Repair or mechanised TIG welding as detailed in TSD594 OP409, in conjunction with the welding data detailed in paragraph 7, and build up the fins on the test pieces as follows:
 - (a) Allow the test piece to cool for 10 to 15 minutes between each weld run.
 - (b) With the test piece for labyrinth 24 (Ref.Fig. 401), use Fin A for TIG welding and Fin B for plasma welding. Weld build-up must not be less than 0.135 in. (3,43 mm) on Fin A and 0.080 in. (2,03 mm) on Fin B.
 - (c) With the test piece for labyrinths 26A and 26B (Ref.Fig.401) weld build-up must not be less than 0.080 in. (2,03 mm).
- C. Identify.
 - (1) Mark 8512055 on the test piece for the No.26A and 26B labyrinths, and B512818 on the test piece for the No.24 labyrinth. Use vibro-percussion marking as instructed in Chapter 72-09-00 Repair.
- D. Examine Test Piece (Ref.Fig.404).
 - (1) Produce four micro sections from the test piece at 90 deg to the weld surface.

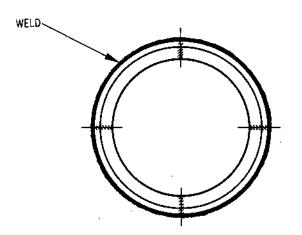








MICRO-SECTION OF TEST PIECE FOR LABYRINTH No's 26A AND 26B



DIAGRAMMATIC VIEW SHOWING POSITIONS OF MICRO-SECTIONS

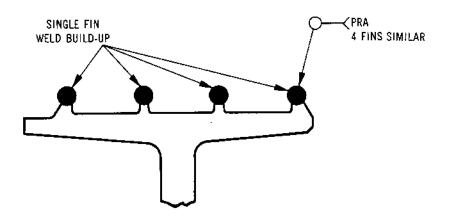
Welding and Hardness Check Details Figure 404

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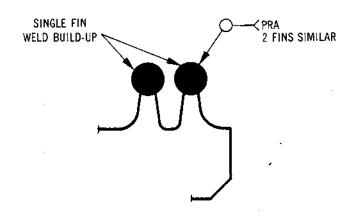
- (2) Subject the micro sections to a VPN hardness check using a 5 kg load and a 2/3 objective in 0.020 in. (0,508 mm) increments.
- (3) Check that the heat affected zone is within the limit shown.

4. Repair Labyrinths No.24, 26A and 26B

- A. Machine Defective Labyrinths.
 - (1) Install the holding fixture (Ref. tool item 1) on a centre lathe and set true to datum diameter.
 - (2) Locate and clamp the labyrinth seal ring assembly to the holding fixture.
 - (3) Machine the defective labyrinth to the dimensions shown in Fig. 402 (plasma weld) or Fig. 403 (TIG weld).
 - (4) Remove the fixture and component from the lathe and detach the component from the fixture.
 - (5) Remove burrs and sharp edges.
 - (6) Inspect the machined areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-51-04 Inspection/Check.
- B. Build Up Labyrinth Fins.
 - (1) Use the plasma welding technique detailed in 72-09-12 Repair or mechanised TIG welding as detailed in TSD594 OP409, in conjunction with the welding data detailed in paragraph 7, and build up the fins as follows:
 - (a) Allow the component to cool for 10 to 15 minutes between each weld run.
 - (b) Weld build-up on labyrinth No.24 must not be less than 0.080 in. (2,03 mm) when using plasma welding. When using TIG welding, build-up must be to a minimum diameter of 16.450 in. (417,83 mm) after welding.
 - (c) Weld build-up on labyrinths No.26A and 26B must not be less than 0.080 in. (2,03 mm) when using plasma or TIG welding.

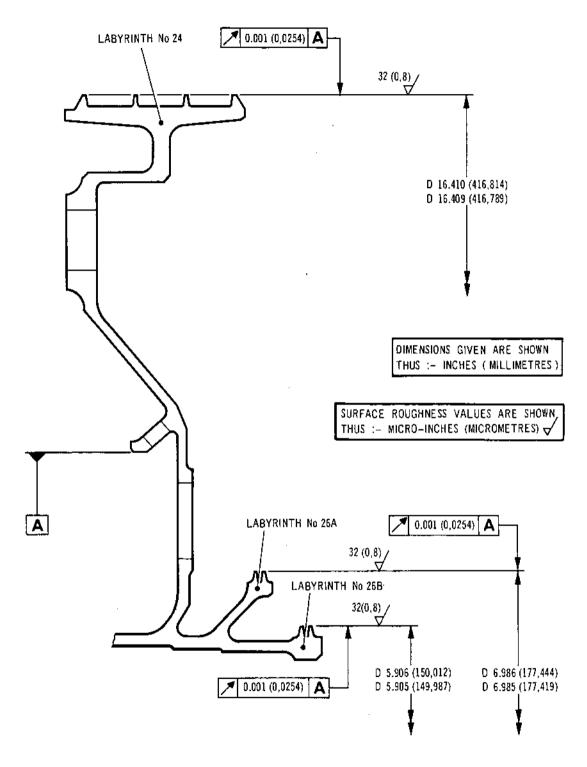


SECTION THROUGH LABYRINTH No 24



SECTION THROUGH LABYRINTH No's 26A AND 26B

Welding Details Figure 405



Labyrinth Diameters - Final Dimensions Figure 406

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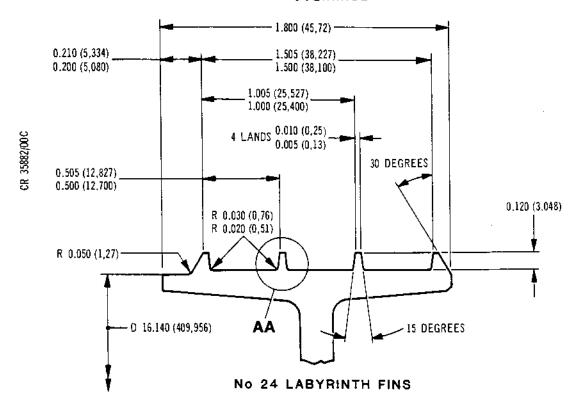
(2) Inspect.

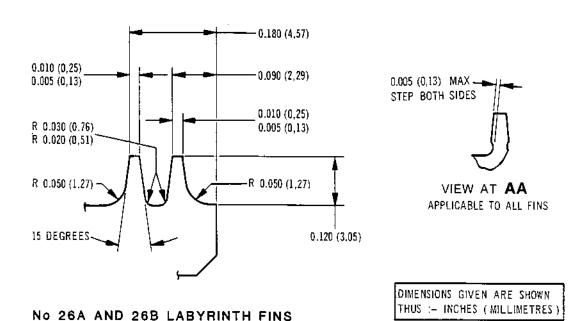
- (a) Inspect to ensure that the weld is satisfactory.
- (b) Carry out dimensional checks to ensure that sufficient depth of weld has been deposited.
- (3) Inspect the labyrinth seal ring for cracks using the fluorescent dye penetrant process specified for this component in 72-51-04, Inspection/Check.
- C. Machine Labyrinth Seal Ring.
 - (1) Install the holding fixture (Ref. tool item 1) on a centre lathe and set true to datum diameter.
 - (2) Locate and clamp the labyrinth seal ring to the holding fixture.
 - (3) Finish turn to obtain the labyrinth outside diameter dimensions shown in Fig. 406.
 - (4) Finish turn to remove any surplus plasma spray from the end face.
 - (5) Finish turn to form labyrinth fins to the dimensions shown in Fig. 407. Use the following tools:
 - (a) Form tools (Ref. tool items 2 and 3) on labyrinth No.24.
 - (b) Form tools (Ref. tool items 2 and 4) on labyrinths No.26A and 26B.
 - (6) Remove burrs and sharp edges.
 - (7) Visually and dimensionally inspect the repaired labyrinths to ensure that machining has been satisfactorily completed.
- D. Heat Treat.
 - (1) Using a vacuum furnace at 760 deg.C (plus or minus 10 deg.C) for 16 hours. Cool using gas fan quench.

2-51-04

REPAIR

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Dimensions for Labyrinth Fin Forming Figure 407

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- E. Etch Repaired Labyrinth Fins.
 - (1) Swab etch each restored labyrinth fin using solution C. Refer to 72-09-14, Repair, for the procedure and details of solution.
- F. Inspect.
 - (1) Inspect the labyrinth seal ring for cracks using the fluorescent dye penetrant crack detection method using the process recommended for this component in 72-51-04, Inspection/Check.
 - G. Vapour Blast Etched Labyrinth Fins.
 - (1) Vapour blast each restored labyrinth fin in accordance with 72-09-13, Repair, using procedure B.
 - H. Identify Repair.
 - (1) Each of the labyrinths to which this repair procedure applies is related to a repair scheme number as follows:

| <u>Labyrinth No.</u> | Repair Scheme No. — Plasma weld | Repair Scheme No. - TIG weld |
|----------------------|------------------------------------|---------------------------------|
| 24 | B488620 | B512815 |
| 26A | B488621 | B512816 |
| 26B | B488622 | в512817 |

- (2) Mark the appropriate repair scheme number(s) close to the standard part number on the labyrinth seal ring; use the vibro-percussion or electro-chemical marking technique (Ref.72-09-00, Repair).
- J. Inspect Labyrinth Seal Ring.
 - (1) Finally inspect the labyrinth seal ring to ensure that the repair has been carried out satisfactorily and that the ring is in a serviceable condition.



5. Special Tools, Fixtures and Equipment

A. The following tools, fixtures and equipment are required to complete this repair.

| <u>Description</u> | Tool No. | <u>Item</u> |
|--------------------|--------------|-------------|
| Holding fixture | S3S 12423000 | 1 |
| Form tool | S3S 12805000 | 2 |
| Form tool | S3S 12811000 | 3 |
| Form tool | S3S 12806000 | 4 |

6. Replacement Parts

None.

7. Welding Data

A. Plasma weld.

| Material: | Waspaloy |
|---------------------|--|
| Weld geometry: | Circumferential |
| Filler wire: | MSRR 9500/202 |
| | 26 swg (0.018 in. (0,46 mm) |
| | diameter) |
| Feed rate (wire): | 48 in. (1219 mm) per minute |
| Machine: | Union Carbide 100 amp |
| Welding current: | 25 to 28 amp |
| Plasma gas (torch): | Argon 0.1 cu ft/h at 30 psi |
| - | (0.047 l/min at 207 kPa) |
| Shield gas (torch): | Argon +5% H ₂ 15 cu ft/h at |
| | 30 psi (7 l/min at 207 kPa) |
| Weld speed: | 5 in./min (127 mm/min) on |
| | Rotorn variable control |
| | turntable |
| Nozzle: | Orifice diameter 0.052 in. |
| | (1,32 mm) |
| Electrode: | 3/32 in. (2,38 mm) diameter |
| | thoriated tungsten |
| Arc length: | 0.150 in. (3,81 mm) |



B. Mechanised TIG weld.

(1) Labyrinth fin No.24.

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK

Electrode Specification: Material: 2% Thoriated

Tungsten

Size: 1/16 in.(1,6 mm) dia.

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991,5 L/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 7.5

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 24 Amps

Weld Mode : Pendant Setting 26.5 Amps

Filler Material Spec. : MSRR 9500/202 (AMS 5828)

Size : 0.030 in. (0,76 mm) dia.

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Feed Rate : 8.8 IPM (224 mm/min.)

Filler Wire Start Delay: 1.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 310

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 40 (6.4 IPM)

Weld Mode : 40 (6.4 IPM)

Increasing to 60 (10 IPM) as Fin Height Progresses

<u>NOTE:</u> All readings shown are machine dial readings unless otherwise indicated.

COMMENTS: Set table at 90°, wire brush after each weld deposit.

(2) Labyrinth Fin No.26A.

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK

Electrode Specification: Material: 2% Thoriated

Tungsten

Size: 1/16 in.(1,6 mm) dia.

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991,5 l/h)

Trailing Gas : -

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Gas Flow Rate : ~

Voltage (AVC) : 7.5

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 18 Amps

Weld Mode : Pendant Setting 20.5 Amps

Filler Material Spec. : MSRR 9500/202 (AMS 5828)

Size : 0.030 in. (0,76 mm) dia.

Feed Rate : 8.5 IPM (216 mm/min.)

Filler Wire Start Delay: 1.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 310

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 40 (2.7 IPM)

Weld Mode : 40 (2.7 IPM) Increasing

to 65 (4.52 IPM) as Fin

Height Progresses

NOTE: All readings shown are machine dial readings unless otherwise indicated.

COMMENTS: Set table at 820, wire brush after each

weld deposit. Set torch angle at 5°.

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(3) Labyrinth Fin No.26B.

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK

Electrode Specification: Material: 2% Thoriated

Tungsten

Size: 1/16 in.(1,6 mm) dia.

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991,5 L/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 7.5

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 18 Amps

Weld Mode : Pendant Setting 20.5 Amps

Filler Material Spec. : MSRR 9500/202 (AMS 5828)

Size : 0.030 in. (0,76 mm) dia.

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Feed Rate : 8.5 IPM (216 mm/min.)

Filler Wire Start Delay: 1.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 310

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 50 (3.01 IPM)

Weld Mode : 50 (3.01 IPM) Increasing

to 80 (4.63 IPM) as Fin

Height Progresses

NOTE: All readings shown are machine dial readings

unless otherwise indicated.

COMMENTS: Set table at 750, wire brush after each

weld deposit. Set torch angle at 5°.



RING, ASSEMBLY, LABYRINTH SEAL, NO.23

PROVISION FOR RESTORING THE DIAMETER OF LABYRINTH FINS BY MECHANISED T.I.G. OR PLASMA WELDING

REPAIR NO. B488593

1. EFFECTIVITY

| <u>IPC</u> | <pre>Fig./Item</pre> | <u>Part No.</u> |
|------------|----------------------|--------------------|
| 72-51-04 | 1 /250A | B919008 B919958 |
| | 1 /250B | B929435 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

A test piece to the requirements of B500230 will be required initially and upon any subsequent change in airline operator, subcontractor, machine or locality.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Remove damping ring from assembly.

Refer Overhaul Manual Chapter 72-51-03 Dis-assembly

2) Machine damaged labyrinth fins to the dimensions given. Hand blend to remove burrs and sharp edges. Refer fig.401.
Refer Para.7. Tools, Item 1.

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| 3) (1 | rack de | tect ma | achined a | aņeas. |
|-------|---------|---------|-----------|--------|
|-------|---------|---------|-----------|--------|

Refer Overhaul Manual Chapter 72-51-04 Inspection/Check

4) Build up labyrinth fins using the mechanised T.I.G. or plasma welding technique. Refer TSD.594 OP.409 (T.I.G.) in conjunction with the welding data detailed in Para.6.A. Data. Refer Overhaul Manual Chapter 72-09-12, Repair (plasma) in conjunction with the welding data detailed in Para. 6.B. Data. Refer fig. 402. Weld build-up must be sufficient to allow finished dimensions to be achieved. Build up the fins as follows: (a) Carry out the first weld run without wire and continue with eight weld runs, on each fin, with wire. (b) Allow the component to cool for 10 to 15 minutes between each weld run. (c) Weld build up must not be less than 0.080 (2,03).

- 5) Carry out dimensional checks to ensure that sufficient depth of weld has been deposited.
- 6) Crack detect.

Refer Overhaul Manual Chapter 72-51-04 Inspection/Check

7) Finish machine the labyrinth fins to the dimensions given., Refer Para.7. TOOLS, item 1 to 3. Refer fig.403 and fig.404.

8) Heat treat the component.

Use a vacuum furnace at 760°C <u>+</u> 10°C for 16 hours. Cool using gas fan quench.

Locally etch areas affected by repair. Refer Overhaul Manual Chapter 72-09-14, Repair, Solution C.

10) Crack detect.

Refer Overhaul Manual Chapter 72-51-04 Inspection/Check

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11) Vapour blast areas affected by repair. Refer Overhaul Manual Chapter 72-09-13, Repair, Procedure B.

12) Dimensionally inspect labyrinth ring diameter AB and record dimension. Refer fig.401.

13) Dimensionally inspect existing damping ring diameter AC (if ring is serviceable) and record dimension.

14) Assemble existing damping ring provided that a 0.001 to 0.002 (0,03 to 0,05) interference will result from dimensions recorded at operation 12) and 13).

Proceed to operation 19).

Refer Overhaut Manual Chapter 72-51-03 Sub-Assembly

Note: Where the required interference cannot be obtained or damping ring is otherwise unserviceable, fit new damping ring using operations 15) to 18).

15) Obtain new damping ring and locate to suitable machine. Set true to datum A and machine diameter AC to produce interference fit of 0.001 to 0.002 (0,03 to 0,05) with labyrinth ring diameter AB recorded at operation 12).

Refer Para.8. Replacement Parts, item 4. Refer fig.401 and 405.

16) Crack detect damping ring.

Refer Overhaul Manual Chapter 72-51-04 Inspection/Check

17) Assemble damping ring to labyrinth ring. Refer Overhaul Manual Chapter 72-51-03 Sub-Assembly. Refer Para.8. Replacement Parts, items 5 to 7.

18) Finally visually inspect the component to ensure the repair has been carried out satisfactorily and that the labyrinth is in a serviceable condition.

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Mark Repair Instruction number 19) RI B488593 or R5 on component adjacent to normal 'assy. of' number using the vibropercussion engraving technique. Refer Overhaul Manual Chapter 72-09-00, Repair.

5. Material

RR. Code Material Component QDY Ring, Assembly, Waspaloy MSRR7034 Labyrinth seal, No.23

6. <u>Data</u>

A. T.I.G weld data (for guidance only)

Hobart dabber welder system Weld process: 400 DC Weld current: 100 amp Amperage: Machined surface, degrease Weld preparation: using M.E.K. OMat 135. Material: 2% thoriated tungsten. Size: Electrode: 0.093(1,59) diameter. OMat 3/153. Argon. Shielding gas: 35 cu ft/hour (991,5 L/hour). Gas flow rate: Trailing gas: Gas flow rate: 7.5 Voltage (AVC): Deadband: 3 Sensitivity: Nο Lock out: 0 Retract distance: 0.05 Starting arc gap:

Start delay: Welding current. Fusion mode:

Weld mode: Filler material spec:

Size:

Feed rate: Wire start delay:

Wire stop delay: Dabber strokes/min: Stroke length:

Pulsation: Weld speed.

Fusion mode: Weld mode:

Pendant setting 24 amps. Pendant setting 26.5 amps.

OMat 3/99.

1.5

0.030(0,76) diameter. 8.8 ins/min (224 mm/min).

1.3 0.1

310 0.5(12)No

6.4 ins/min (163 mm/min).

6.4 ins/min (163 mm/min) increasing to 10 ins/min (254 mm/min) as fin height

progresses.

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B. Plasma Weld Data (for guidance only)

Weld Geometry:

Circumferential.

Filler Wire:

OMat 3/99

Feed rate (wire):

26 SWG 0.018(0,46) diameter. 40.0 ins/min (1041 mm/min).

Machine:

Union Carbide 100 amp

with fine wire feed.

Welding current:

25 to 28 amps.

Plasma gas (torch):

Argon 0.2 cu ft/h at 30 Psi (0.094 L/min at 207 kPa).

Shield gas (torch):

Argon plus 5% Hydrogen. 15 cu ft/hour

at 30 Psi (7 L/min at 207 kPa).

Weld speed:

5.5 ins/min (140 mm/min) on

Rotorn variable control

turntable.

Nozzle:

Orifice diameter 0.052(1,32).

0.094(2,38) diameter

thoriated tungsten.

OMat 3/154. ..

Arc length:

Electrode:

0.150(3,81).

NOTE: All readings shown are machine dial readings unless otherwise indicated. Set table at 900, wire brush after each weld.

7. TOOLS

| TOOL NUMBER | DESCRIPTION | <u>item</u> |
|---------------|-----------------|-------------|
| \$3\$12422000 | Holding Fixture | 1 |
| \$3\$12805000 | Form Tool | 2 |
| \$3\$12806000 | Form Tool | 3 |

8. REPLACEMENT PARTS

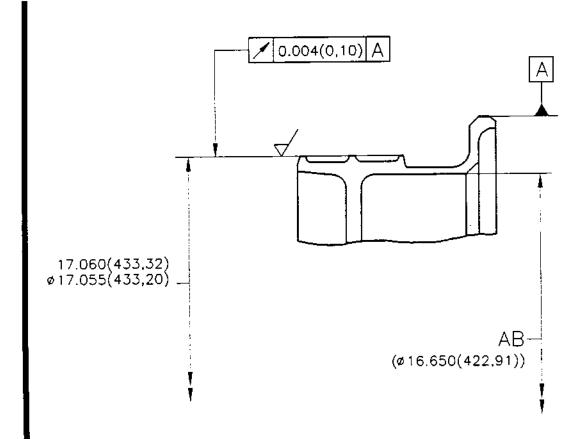
| PART NUMBER | DESCRIPTION | QUANTITY | <u>ITEM</u> |
|-------------|-------------------|-------------|-------------|
| B376585 | Ring, Damping | 1 | 4 |
| B479681 | Bolt, Dee Head | 5 | 5 |
| A\$20625 | Nut, self locking | 5 | 6 |
| B376587 | Washer, flat | 5 | 7 |
| B500230 | Test piece | 1 (if req'd |) 8 |

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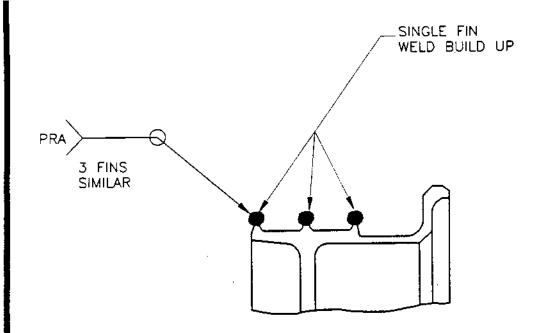
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TYPICAL SECTION SHOWING PRE-WELD MACHINING FIG.401

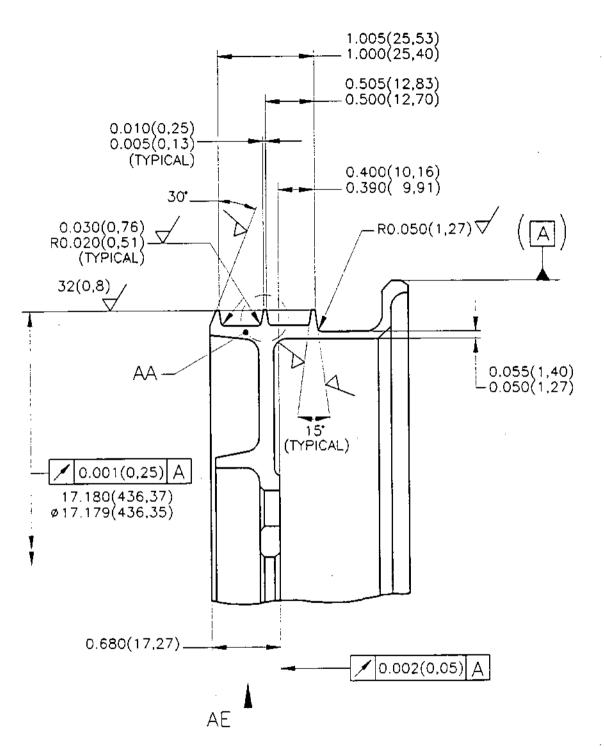
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TYPICAL SECTION SHOWING WELD BUILD UP FIG.402

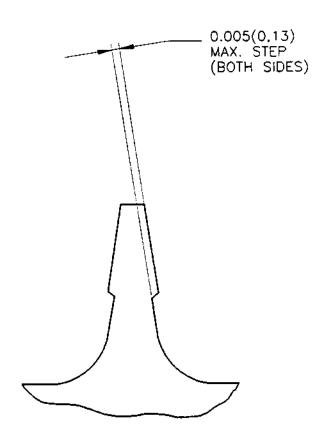
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TYPICAL SECTION SHOWING FINISHED DIMENSIONS FIG. 403

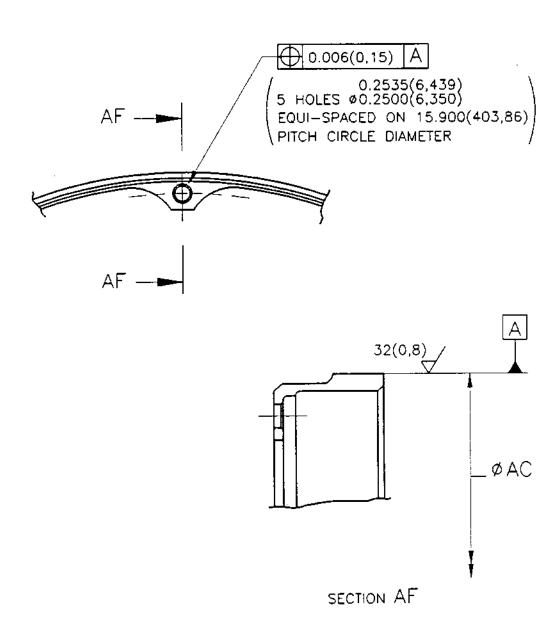
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DETAIL AA (APPLICABLE TO ALL FINS) FIG.404

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MACHINING OF DAMPING RING FIG.405

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HP TURBINE HUB ASSEMBLY - LABYRINTH NO'S.16 TO 22 RESTORED BY TIG WELDING

MODIFICATION NO. OL.8902C

1. Effectivity

| IPC | <pre>Fig./Item</pre> | <u>Part No.</u> |
|----------|----------------------|----------------------------------|
| 72-51-04 | 1 /300A | 8.439926 B.922102 |
| | 1 /3008 | B.514134 B.514135 B.514136 |
| | | B.514137 B.903996 B.922103 |

2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE

VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 141/B488632 to 38.

- (1) This repair describes the procedure for restoring the labyrinths number 16, 17, 18, 19, 20, 21 and 22 by mechanised TIG welding and machining to standard dimensions.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair for all standard practices applicable to this repair procedures.
- (4) The operations that are subject to Component Manufacturing Technique control are indicated CMT.
- (5) A test piece shall be produced and subjected to metalurgical examination; test pieces are required initially and upon any subsequent change of airline operator, sub-contractor, machine or locallity. Test pieces are also required after every ten component repairs or annually, where time elapsed between component repairs exceeds one year.

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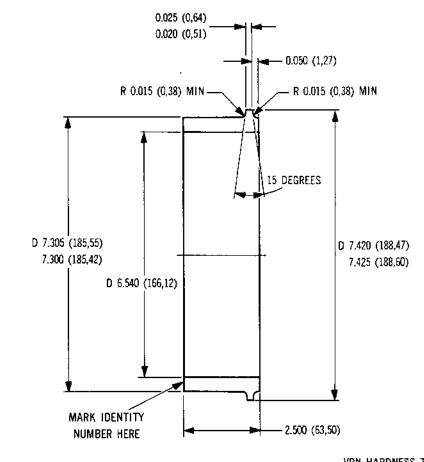
OVERHAUL

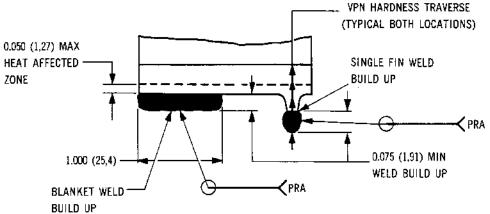
- Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) (6) unless otherwise stated.
- (7)Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (8) Tolerances on all angles are pius/minus 2 degrees unless otherwise stated.
- (9) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (10) All tools referred to by item number in procedural steps are detailed in para.5.
- (11) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. Test Piece

- Produce Test Piece. Α.
 - Produce a test piece from fully heat-treated MSRR.7084 material to the dimensions given in Fig. 401.
 - (2) It is permissible to use an unserviceable standard part as a test piece. In this case, machine the labyrinth fins to the dimensions given in Fig. 404.
 - Remove sharp edges from the fins. (3)
 - (4) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.
- в. Weld Test Piece.
 - Build up the single fin to a minimum height of 0.075 in. (1,91 mm) as indicated in Fig. 401 by mechanised TIG welding using filler rods OMat 3/99 as instructed in TSD 594 OP 409.
 - Build up the blanket weld with a single weld run only, as indicated in Fig. 401 by mechanised TIG welding using filler rods OMat 3/99 as instructed in TSD 594 OP 409.

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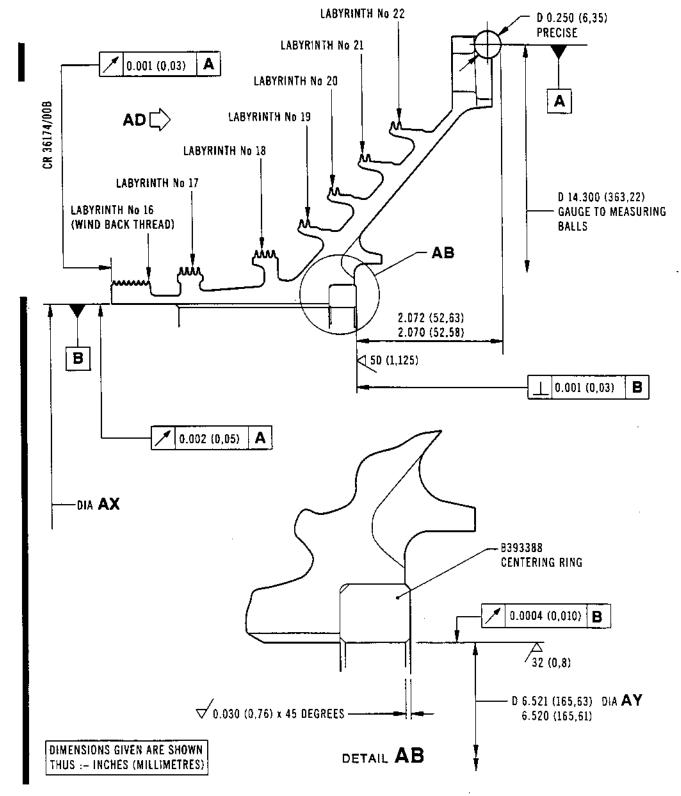
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Test Piece Details Figure 401

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OVERHAUL



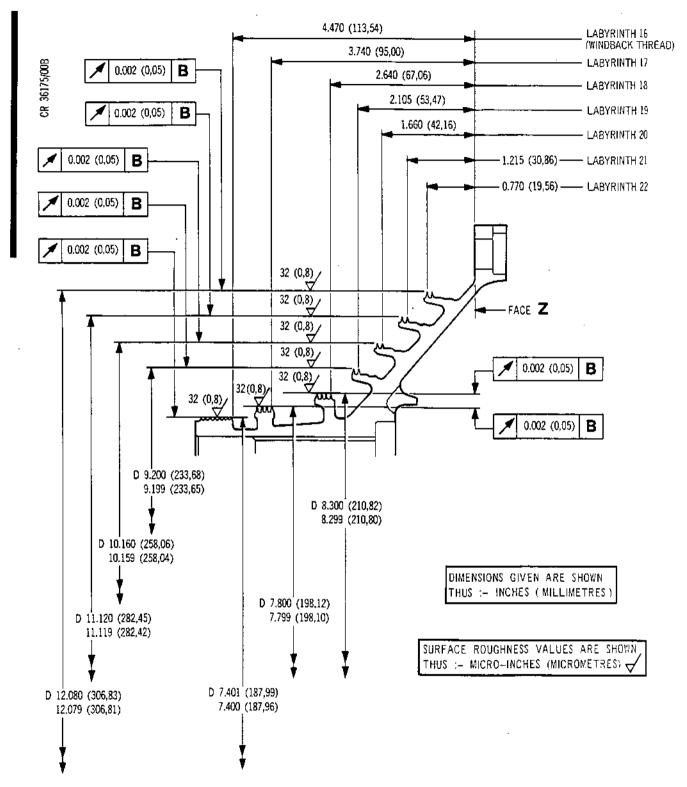
HP Turbine Rotor Hub Figure 402

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MK.610-14-28 snecma OVERHAUL

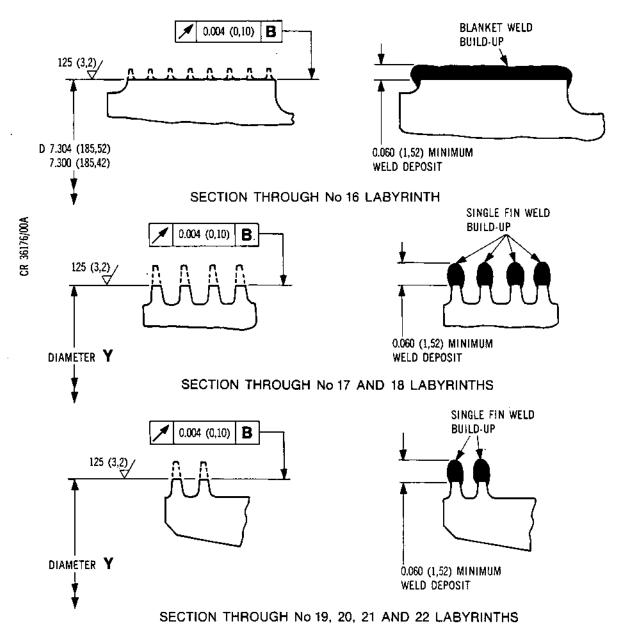


Standard Dimensions Figure 403

REPAIR

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| LABYRINTH | 17 | 18 | 19 | 20 | 21 | 22 |
|-----------|----------------|----------------|----------------|-----------------|-----------------|-----------------|
| DIAMETER | 7.684 (195,17) | 8.184 (207,87) | 9.084 (230,73) | 10.044 (255,12) | 11.004 (279,50) | 11.964 (303,88) |
| Y | 7.680 (195,07) | 8.180 (207,77) | 9.080 (230,63) | 10.040 (255,02) | 11.000 (279,40) | 11.960 (303,78) |

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Machining and Welding Details Figure 404

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C. Machine.

(1) Locate the test piece in a lathe and machine the blanket weld only, removing the minimum material, until the surface is free of defects, e.g. voids, porosity, etc.

D. Inspect.

(1) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.

E. Weld.

(1) Repeat operations in paras. 38(2) to 3D until the minimum build-up is achieved (Ref.Fig.401).

F. Heat Treat.

(1) Heat treat the test piece in argon gas at 760 deg.C plus/minus 10 deg.C for 16 hours in Argon. Cool in air.

G. Identify.

(1) Mark B509157 on the test piece using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.

H. Inspect.

(1) Inspect the blanket weld only, using the ultrasonic C-scan process as specified in Chapter 72-09-00 Inspection/Check.

J. Metallurgical Examination.

<u>NOTE:</u> The following examination must be carried out by the controlling laboratory.

- (1) Produce four suitable micro-sections at 90 deg. from the test piece surface.
- (2) Subject the micro-sections to a VPN hardness check using a 5 kg load and 2/3 rds objective at 0.020 in. (0,51 mm) increments, traversed across the micro-sections. Check that the heat affected zone is limited to the area shown in Fig.401 (test piece) or Fig.409 (unserviceable standard part).

REPAIR

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Instructions

- Machine. Α.
 - Remove centering ring from hub.
 - (2) Locate the hub assembly to a centre lathe faceplate, and set true.
 - Machine the seal fins of the No.16, 17, 18, 19, 20, 21 (3) and 22 labyrinths to the dimensions given in Fig. 404.
 - (4) Remove burrs and sharp edges.
- В. Inspect.
 - Inspect for the satisfactory completion of the (1) machining operation.
 - (2) Measure and record the position of the fins on the labyrinths No.17, 18, 19, 20, 21 and 22 (Ref. Fig. 405 and 406).
 - (3) Dimensionally inspect centering ring location as instructed in Chapter 72-51-04 Inspection/Check.
 - (4) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in CMT Chapter 72-51-04 Inspection/Check.

С. Weld.

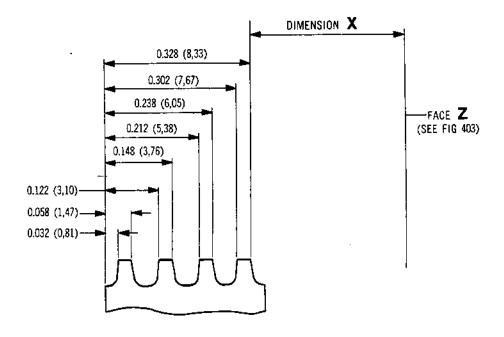
- Build-up the fins of the No.17, 18, 19, 20, 21 and 22 (1) labyrinths as indicated in Fig. 403, by mechanised TIG welding using filler rods OMat 3/99 as instructed in TSD 594 OP 409. Weld build-up must be sufficient to allow finish dimensions to be achieved (Ref.Fig.402 and 408). Refer to para.7 for welding CMT details.
- (2) Build-up the No.16 labyrinth location as indicated in Fig. 404, by a single weld run only, using mechanised TIG welding with filler rods OMat 3/99 as instructed in TSD 594 OP 409. Refer to para.7 CMT for welding details.

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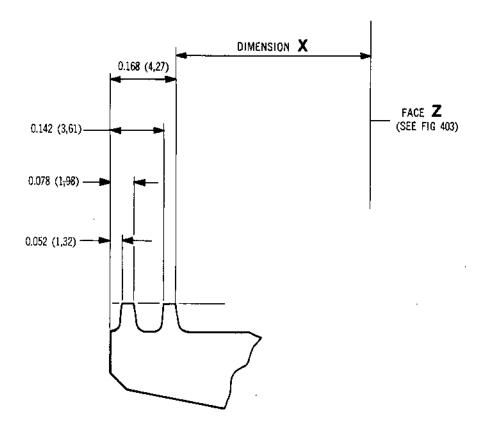
SECTION THROUGH No 17 AND 18 LABYRINTHS

| LABYRINTH | 17 | 18 |
|-------------|---------------|---------------|
| DIMENSION X | 3.732 (94,79) | 2.632 (66,85) |

DIMENSIONS GIVEN ARE SHOWN Thus:— Inches (MILLIMETRES)

Reference Dimensions Figure 405

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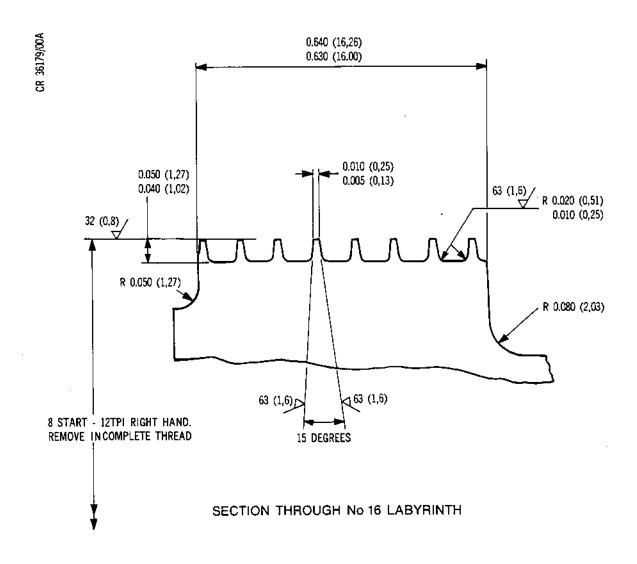
SECTION THROUGH No 19, 20, 21 AND 22 LABYRINTHS

| LABYRINTH | 19 | 20 | 21 | 22 |
|-----------|---------------|---------------|----|---------------|
| DIMENSION | 2.097 (53,26) | 1.652 (41,96) | | 0.762 (19,35) |

DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

Reference Dimensions Figure 406

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DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Machining Details Figure 407

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D. Machine.

- (1) Locate the hub assembly to a centre lathe faceplate, and set true.
- (2) Machine the No.16 labyrinth seal location, removing the minimum material, until the surface is free of all defects, e.g. voids, porosity etc.

E. Inspect.

(1) Inspect the No's.16, 17, 18, 19, 20, 21 and 22 seal locations using the fluorescent dye penetrant process specified for this component in Chapter 72-51-04, Inspection/Check.
CMT

F. Weld.

(1) Repeat the welding, machining and inspection operations for labyrinth No.16 only as instructed in paragraphs 4C(2), 4D and 4E, until sufficient material is built up to achieve the finish dimensions (Ref. Fig.402 and 407).

G. Inspect.

- (1) Inspect the hub assembly for distortion (Ref. Fig. 402).
- (2) Inspect the welding as detailed in TSD 594 OP 409.
- (3) Inspect the hub assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-51-04 Inspection/Check.
- (4) Inspect the No.16 labyrinth location using the ultrasonic C-scan process as specified in Chapter 72-09-00 Inspection/Check. CMT

H. Machine.

(1) Locate the hub assembly to a centre lathe faceplate, and set true.

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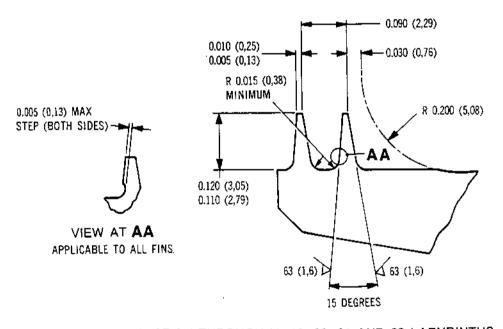
CMT

OVERHAUL

0.320 (8,13) 0.275 (6,99) 0.270 (6,86) 0.010 (0,25) 0.185 (4,70) 0.005 (0,13) 0.180 (4,57) 0.095 (2,41) 0.090 (2,29) **-**0.040 (1,02) 0.120 (3,05) 0.110 (2,79) AA 63 (1,6) 63 (1,6) 15 DEGREES

CR 36180/00B

SECTION THROUGH No 17 AND 18 LABYRINTHS



SECTION THROUGH No 19, 20, 21 AND 22 LABYRINTHS

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS := MICRO-INCHES (MICROMETRES)

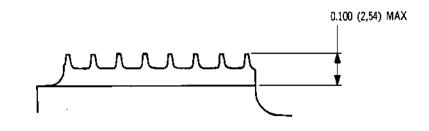
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Machining Details Figure 408

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REPAIR



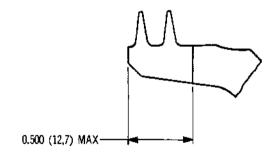


LABYRINTH No 16



CR 36181/00A

LABYRINTHS No 17 AND 18



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

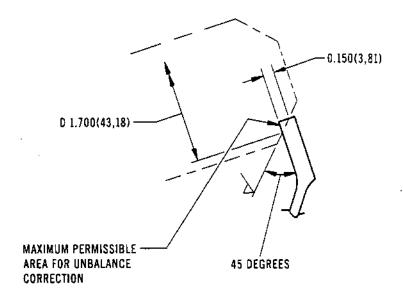
LABYRINTHS No 19, 20, 21 AND 22

Heat Affected Zones Figure 409

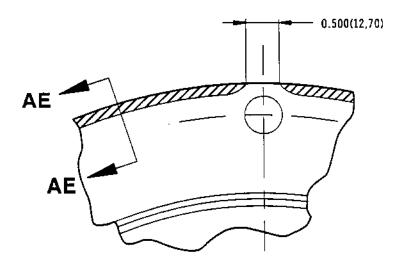
72-51-04
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4K_610-14-28 snecmi OVERHAUL

CR 36431/00A



SECTION AE - AE



VIEW AT AD

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Balancing Details Figure 410

REPAIR

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MK.610-14-28 snecma OVERHAUL

(2) Finish machine the fins of No.17, 18, 19, 20, 21 and 22 labyrinths using form tool ref. tool item 1, to the dimensions given in Fig.403 and 408. Use the dimensions previously recorded (para.4B(3)) to ensure that the maximum step is 0.005 in. (0,13 mm) (Ref.Fig.408 view AA).

CMT

- (3) Finish machine the No.16 labyrinth (windback seal) using form tool ref. tool item 2, to the dimensions given in Fig.403 and 407.
- J. Heat Treat.
 - (1) Heat treat hub assembly in an inert gas or vacuum furnace at 760 deg.C plus/minus 10 deg.C for 16 hours. Rapid gas quench.
 CMT

K. Inspect.

- (1) Inspect for the satisfactory completion of the machining operation.
- (2) Chemically etch the repaired areas as instructed in Chapter 72-09-14 Repair, using Solution C. CMT
- (3) Inspect the hub assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-51-04 Inspection/Check. CMT
- (4) Visually inspect centering ring and hub location to Chapter 72-51-04 Inspection/Check.

L. Vapour Blast.

- (1) Mask off the hub assembly with suitable waterproof masking tape. Ensure that only the repair area is exposed.
- (2) Vapour blast the labyrinth fins as instructed in Chapter 72-09-13 Repair, using 320/400 mesh aluminium oxide grit at Almen 2N (Minimum) intensity.

M. Balance.

- Replace centering ring.
 - (a) Heat ring to 100 deg.C plus/minus 10 deg.C and assemble.

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MK.610-14-28 snecma OVERHAUL

- (b) If new centering ring fitted, machine to dimensions shown (Ref.Fig. 402, View on AB).
- (2) With assembly located off diameters AX and AY, statically balance to a maximum initial unbalance of 60 drm/ins (2,700 grm/mm). Unbalance correction to be achieved by removal of material from the balancing positions (Ref.Figs.402 and 410).
- N. Inspect.
 - (1) Inspect the hub assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-51-04 Inspection/Check.
 CMT
- P. Identify.
 - (1) Mark the appropriate salvage number (Ref. Table 401) adjacent to the existing part number, using electrochemical or vibro-percussion marking as specified in Chapter 72-09-00 Repair.

| SALVAGE NO. | LABYRINTH NO. | TEST PIECE |
|-------------|---------------|------------|
| B488632 | 16 | B509197 |
| B488633 | 17 | B509197 |
| B488634 | 18 | B509197 |
| B488635 | 19 | B509197 |
| B488636 | 20 | B509197 |
| B488637 | 21 | B509197 |
| 8488638 | 22 | B509197 |

Table 401

- R. Final Inspection.
 - (1) Finally inspect the hub assembly to ensure that the repair has been carried out satisfactorily and that the hub assembly is in a serviceable condition.
- 5. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Qty.</u> | Part No. | <u>Item</u> |
|--------------------|-------------|---------------------------------|-------------|
| Form tool | 1 | s3s 15511000 | 1 |
| Form tool | 1 | \$ 3 \$ 1 5510000 | 2 |

REPAIR

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6. Replacement Parts

None.

7. Welding Machine Data

A. Labyrinth Fin No.16 (Blanket Weld).

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : Hy-plas

Gas Flow Rate : 35 CFH (991,5 l/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 8.8

Deadband : 4

Sensitivity: 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 2.7

Welding Current

Fusion Mode : Pendant Setting 35 Amps

Weld Mode : Pendant Setting 45 Amps

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IK 1610-14-28 snecma OVERHAUL

Filler Material Spec. : OMat 3/99

Size : 0.030 in. (0,76 mm) dia.

Feed Rate : 8.0 IPM (203 mm/min.)

Filler Wire Start Delay : 2.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 315

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 60

Weld Mode : 60

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

COMMENTS: Set table at 80°, wire brush after each weld

deposit.

B. Labyrinth Fin No.17 (Individual).

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : Argon

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Gas Flow Rate : 35 CFH (991,5 l/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 7.1

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 27 Amps

Weld Mode : Pendant Setting 35.5 Amps

Filler Material Spec. : OMat 3/99

Size : 0.030 in. (0,76 mm) dia.

Feed Rate : 7.6 IPM (193 mm/min.)

Filler Wire Start Delay : 1.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 405

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 75

Weld Mode : 75 Increasing to 110 as Fin

Height Progresses

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<u>NOTE:</u> All readings shown are machine dial readings unless otherwise indicated.

COMMENTS: Set table at 90°, wire brush after each weld deposit.

C. Labyrinth Fin No.18 (Individual).

Material : Waspaloy

Weld Process : Hobart Dabber Welder System

Weld Current : 400 DC

Amperage : 100 Amp

Weld Preparation : Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991,5 l/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 7.2

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

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OVERHAUL

Welding Current

Pendant Setting 27 Amps Fusion Mode :

Weld Mode Pendant Setting 32 Amps

Filler Material Spec. : OMat 3/99

0.030 in. (0,76 mm) dia. Size

7.6 IPM (193 mm/min.) Feed Rate

1.3 Filler Wire Start Delay

Filler Wire Stop Delay 0.1

Dabber Strokes/Min : 325

0.470 in. (12 mm) Stroke Length

Pulsation No

Weld Speed

Fusion Mode 70

70 Increasing to 100 as Fin Weld Mode

Height Progresses

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

Set table at 900, wire brush after each weld COMMENTS:

deposit.

Labyrinth Fin No.19 (Individual). D.

> Material Waspaloy

Hobart Dabber Welder System Weld Process :

400 DC Weld Current

Amperage 100 Amp

Machined Surface, Degrease Weld Preparation

using MEK. OMat 135

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1K.610-14-28 snecma OVERHAUL

Electrode Specification : Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991,5 l/h)

Trailing Gas : -

Gas Flow Rate : +

Voltage (AVC) : 7.2

Deadband : 4

Sensitivity: 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 27 Amps

Weld Mode : Pendant Setting 32 Amps

Filler Material Spec. : OMat 3/99

Size : 0.030 in. (0,76 mm) dia.

Feed Rate : 7.6 IPM (193 mm/min.)

Filler Wire Start Delay : 1.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 309

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

REPAIR

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Repair No.6 Page 423 Jan 31/94 Weld Speed

Fusion Mode

70

Weld Mode

70 Increasing to 100 as Fin

Height Progresses

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

COMMENTS: Set table at 900, wire brush after each weld

deposit.

E. Labyrinth Fin No.20 (Individual).

Material

: Waspaloy

Weld Process

Hobart Dabber Welder System

Weld Current

400 DC

Amperage

: 100 Amp

Weld Preparation

Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

Omat 3/153

Shielding Gas

Argon

Gas Flow Rate

: 35 CFH (991,5 l/h)

Trailing Gas

:

:

Gas Flow Rate

_

Voltage (AVC)

7.3

Deadband

: 4

Sensitivity

3

Lock Out

No

Retract Distance

0

REPAIR

72-51-04

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K.610-14-28 snec OVERHAUL

Starting Arc Gap

0.05

Start Delay

1.5

Welding Current

Fusion Mode

: Pendant Setting 27 Amps

Weld Mode

Pendant Setting 32 Amps

Filler Material Spec.

OMat 3/99

Size

0.030 in. (0,76 mm) dia.

Feed Rate

: 7.6 IPM (193 mm/min.)

Filler Wire Start Delay

1.3

Filler Wire Stop Delay

0.1

Dabber Strokes/Min

309

Stroke Length

0.470 in. (12 mm)

Pulsation

No

Weld Speed

Fusion Mode

60

Weld Mode

60 Increasing to 90 as Fin

Height Progresses

<u>NOTE:</u> All readings shown are machine dial readings unless otherwise indicated.

COMMENTS: Set table at 90°, wire brush after each weld deposit.

:

F. Labyrinth Fin No.21 (Individual).

Material

: Waspaloy

Weld Process

Hobart Dabber Welder System

Weld Current

400 DC

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Amperage :

Weld Preparation : Machined Surface, Degrease

using MEK. Omat 135

Electrode Specification : Material: 2% Thoriated

Tungsten

100 Amp

Size: 1/16 in. (1,6 mm) dia.

Omat 3/153

Shielding Gas : Argon

Gas Flow Rate : 35 CFH (991,5 L/h)

Trailing Gas : -

Gas Flow Rate : -

Voltage (AVC) : 7.1

Deadband : 4

Sensitivity : 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 27 Amps

Weld Mode : Pendant Setting 32 Amps

Filler Material Spec. : OMat 3/99

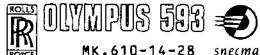
Size : 0.030 in. (0,76 mm) dia.

Feed Rate : 7.6 IPM (193 mm/min.)

Filler Wire Start Delay : 1.3

Filler Wire Stop Delay : 0.1

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1K.610-14-28 snecma OVERHAUL

Dabber Strokes/Min

: 309

Stroke Length

0.470 in. (12 mm)

Pulsation

No

Weld Speed

Fusion Mode

50

Weld Mode

50 Increasing to 80 as Fin

Height Progresses

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

COMMENTS: Set table at 900, wire brush after each weld

deposit.

G. Labyrinth Fin No.22 (Individual).

Material

: Waspaloy

Weld Process

: Hobart Dabber Welder System

Weld Current

400 DC

Amperage

: 100 Amp

Weld Preparation

Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas

: Argon

Gas Flow Rate

: 35 CFH (991,5 L/h)

Trailing Gas

:

Gas Flow Rate

;

Voltage (AVC)

7.0

Deadband

.

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OVERHAUL

Sensitivity 3

Lock Out No

0 Retract Distance

Starting Arc Gap 0.05

1.5 Start Delay

Welding Current

Fusion Mode Pendant Setting 27 Amps

Weld Mode Pendant Setting 32 Amps

OMat 3/99 Filler Material Spec.

Size 0.030 in. (0,76 mm) dia.

7.4 IPM (188 mm/min.) Feed Rate

Filler Wire Start Delay 1.3

Filler Wire Stop Delay 0.1 :

Dabber Strokes/Min 309

Stroke Length 0.470 in. (12 mm)

Pulsation No

Weld Speed

45 Fusion Mode

Weld Mode 45 Increasing to 65 as Fin

Height Progresses

All readings shown are machine dial readings unless NOTE:

otherwise indicated.

Set table at 90°, wire brush after each weld COMMENTS:

deposit.

REPAIR

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RING LABYRINTH SEAL NOS.24 AND 26 - REPAIR RESTORATION OF OUTSIDE LOCATION DIAMETER WITH PLASMA SPRAY

MODIFICATION NO. OL.8963

1. Effectivity

| I.P.C. | Fig. | <u>/Item</u> | Part No. |
|----------|------|--------------|----------|
| 72-51-04 | 1 | 160A | B925413 |

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the outside location diameter of ring labyrinth seal No. 24 and 26 with plasma spray.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Place the labyrinth seal ring in a suitable protective container during transit between operations to avoid damage.

B. Repair Limitations.

- (1) Compliance with all aspects of these repairs should be achieved without deviation. Where a need to deviate is considered necessary, agreement should first be sought from the Repair Authority.
- (2) Labyrinth seal ring diameters may be restored using this repair process provided that the repairable location diameter is not less than 5.830 in. (148,08 mm) after preparatory machining.

REPAIR

72-51-04

3. Instructions

- A. Preparation.
 - (1) Refer to Figures 401 and 402. Mount the component in a lathe and set true to datum A.
- B. Machine.
 - (1) Machine the worn diameter to the pre-spray diameter of not less than the dimension given in para.2.B.(1) above.
- C. Inspect.
 - (1) Inspect the machined area for cracks using the fluorescent dye penetrant check specified for this component in Chapter 72-51-04, Inspect/Check.
- D. Plasma Spray.
 - (1) Refer to Figure 402. Mask off all areas except AB.
 - (2) Plasma spray area AB using MSRR9507/14 (Metco 443 NS) as instructed in Chapter 72-09-11, Repair, to sufficient thickness to allow the achievement of the final machined diameter.
- E. Inspect.
 - Refer to TSD 594-704, Section 8. Visually inspect the coating for defects.
- F. Grind.
 - (1) Refer to Figures 401 and 403. Mount the component in a universal grinder and set true to datum A.
 - (2) Grind the location to the post spray diameter.
- G. Inspect.
 - (1) Refer to Figure 403. Check dimension of repaired diameter.
 - (2) Refer to TSD 594-704 Section 8. Visually inspect the coating for defects.

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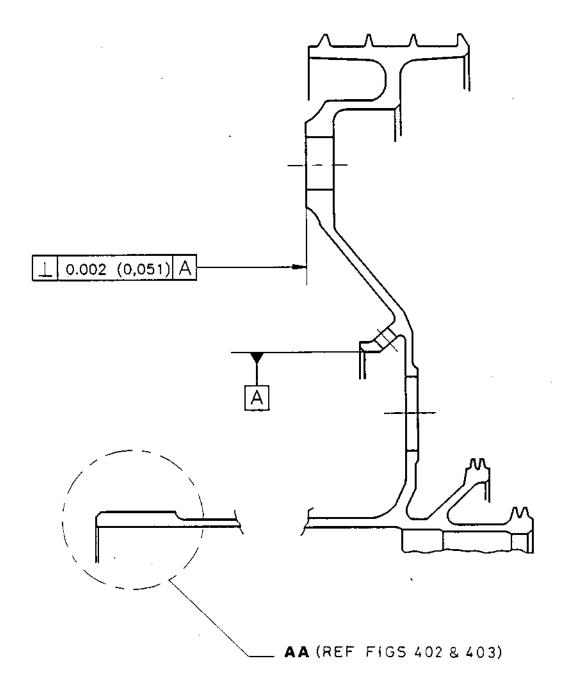
- H. Identify.
 - (1) Mark on SAL B513490 and the coating symbol adjacent to the existing part number using the vibro-percussion marking as specified in Chapter 72-09-00, Repair.
- J. Final Inspection.
 - (1) Finally inspect to ensure that the repair has been carried out satisfactorily and that the component is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.

72-51-04



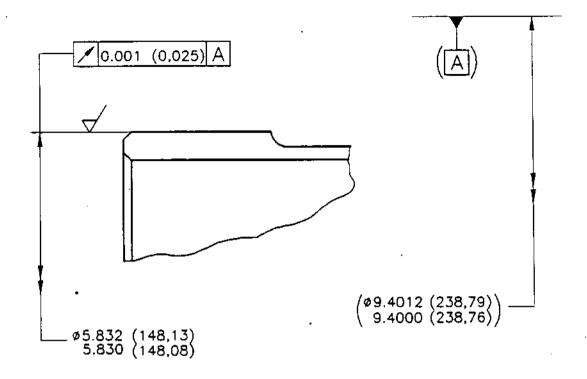
DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

Ring Labyrinth Seal Nos. 24 and 26 Figure 401

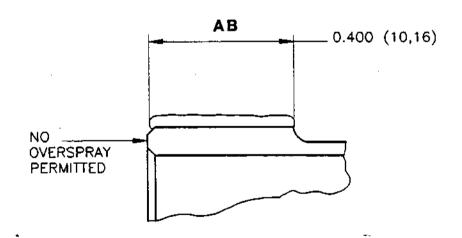
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DETAIL AT AA (REF FIG 401) SHOWING PRE-COATING MACHINING



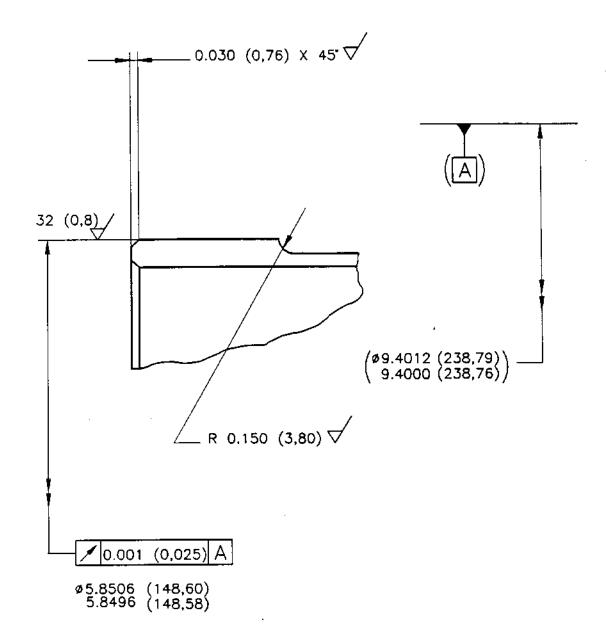
DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES) REPEAT DETAIL AT AA (REF FIG 401) SHOWING PLASMA SPRAY DETAILS

Ring Labyrinth Seal Nos. 24 and 26 Figure 402

REPAIR

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DETAIL AT **AA** (REF FIG 401) SHOWING POST SPRAY MACHINING

DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Ring Labyrinth Seal Nos. 24 and 26 Figure 403

REPAIR

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LP TURBINE ASSEMBLY - REPAIR

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| 1 | | P Turbine Nozzle Vane Repaired by removal and Replacement of Guide Tube. | SAL.B.478060 |
| 2 | | P Turbine Nozzle Vane Replace- ment of Blank Plates Guide Tube and Guide Block | SAL.B.478061-A |
| 3 | | P Turbine Nozzle Vane Repaired by Welding Cracks. | SAL.B.497462-A |
| 4 | | P Turbine Nozzle Vane Repaired by Restoring Front and Rear Location Feet Using Weld Applied Stellite 12. | SAL.B.499430-1 |
| 5 | | P Turbine Nozzle Vane - Replacement of Blanking Plates | SAL.B.478063 |
| 6 | | P Turbine Nozzle Vane - Replacement of Tack Welded Guide Tube | SAL.B.511466 |
| 7 | N | ozzle Vane Support Diaphragm Assembly - Replacement of Damaged No.24 and 25 Labyrinth Rings | SAL.B.513548 |
| 8 | ` | ane A/O Nozzle Turbine LP Restoration of Cracked Outer Blank Plates | SAL.B.513545 |
| 9 | ī | Diaphragm, Assembly of, Nozzle Vane Support Restore Vane Locating Slots by Welding | SAL.B.513549 |
| 1 10 | 1 | Diaphragm, Assembly of, Nozzle Vane Support Repair of Fretted Front and/or Rear Stator Supports by Welding. | SAL.B.492927-28 |

Printed in England

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| | Repair No. | Title | Scheme No. |
|-----------|------------|---|--------------|
| pu | 11 | Vane, Assembly of, Nozzle, Turbine, LP. Repair of trailing edge and fillet radius cracks by vacuum brazing. | SAL.B.515031 |
| Englan | 12 | Cancelled | SAL.B.516056 |
| rinted in | 13 | Diaphragm, Assembly of, Nozzle Vane Support. Dressing of light fretting from the front flange adjacent to the vane hook location. | SAL.B.516721 |
| D. | 14 | Vane, Assembly of, Nozzle, Turbine, LP. Repair of trailing edge and fillet radius cracks by vacuum brazing (Post Mod. 8993 Std). | SAL.B.517103 |
| | 15 | Diaphragm, Assembly of, Nozzle Vane Support. Repair of crack(s) at vane locating dog (slot) positions by welding. | SAL.B.517822 |
| | 16 | To Be Issued | |
| | 17 | Diaphragm, Assembly of, Nozzle Vane Support~ Restoration of Worn Seal Fin by Mechanised T.I.G. Welding | SAL.B.518042 |

LP TURBINE NOZZLE VANE - REPAIR REMOVAL AND REPLACEMENT OF GUIDE TUBE MODIFICATION NO. OL.8384C AND 8760C

1. Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|-----------|--------------------|
| 75-52-01 | 1 1104 | в.927217 |
| | 1 1108 | B.932863, B.933354 |
| | 1 1100 | в.933370 |
| | 1 1101 | B.933393, B.933392 |
| | | B.934120 |
| | 1 1101 | B.515714, B.515718 |
| | | B.515722, B.517346 |

Introduction

A. General.

- (1) This repair describes the procedure for removing and replacing guide tubes in vanes.
- (2) Dimensions are shown thus in tables and illustrations: INCHES(MILLIMETERS).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (6) All tools referred to by item number in procedural steps are detailed in paragraph 4.
- (7) Ensure the vane is suitably protected to avoid corrosion and damage, during transit between operations and upon completion of this repair.

72-52-01

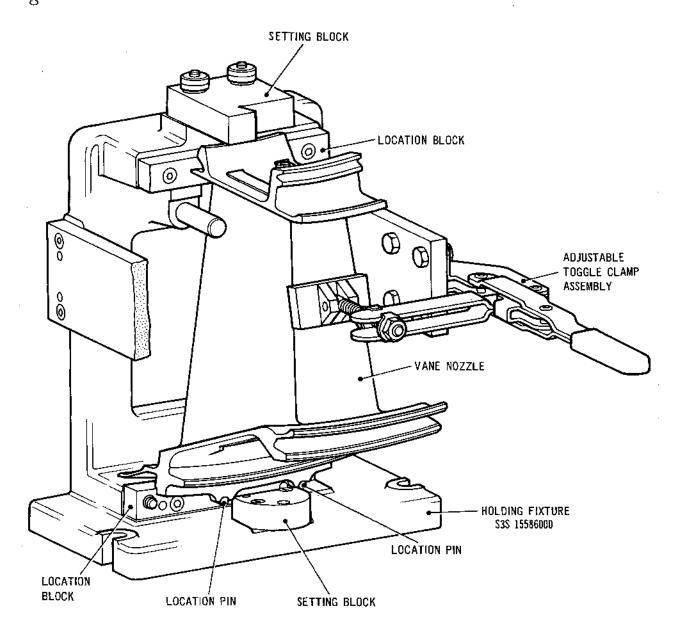
Repair No.1

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REPAIR

CR 35477/00A



Holding Fixture Figure 401

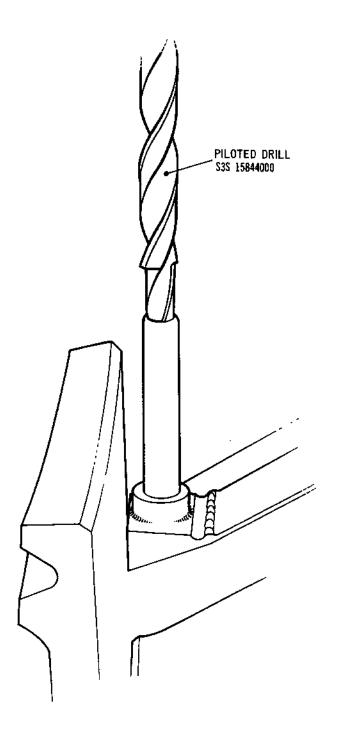
72-52-01 Repair No.1 Page 402 Feb 1/82

3. <u>Instructions</u>

- A. Remove Defective Guide Tube.
 - (1) Locate the vane to fixture ref. tool item 1 as shown in Fig.401, and locate to drilling machine. Do not over-tighten the adjustable toggle clamp causing distortion. Only the toggle clamp shown on Fig.401 is used during the drilling operation; for clarity the clamp on the opposite side is not shown.
 - (2) Using piloted drill ref. tool item 2, drill to remove defective guide tube (Ref.Fig.402). Drilling must be carried out to a depth sufficient to remove guide tube, but must stop short of the outer blanking plate and retaining block (Ref.Fig.403).
 - (3) Remove fixture/vane assembly from the drilling machine and the vane from the fixture.
 - (4) Using a hand drill nolding a 0.234 in. (5,95 mm) drill remove the remains of the guide tube from the outer blanking plate and retaining block (Ref. Fig.403). Care must be taken not to damage existing parts.
 - (5) Dress to clean up outer and inner locations, and remove any swarf from inside vane.
 - (6) View to ensure satisfactory removal of guide tube.
 - (7) Test the vane for cracks using the fluorescent dye penetrant process specified for this component in 72-52-01, Inspection/Check.
- B. Assemble Replacement Guide Tube.
 - Withdraw from stores replacement guide tube B.429207.
 - (2) Insert the guide tube through the vane guide block and locate the shouldered end into the vane retaining block (Ref.Fig.403).
 - (3) Support the guide tube in position using support mandrel ref. tool item 3 (Ref.Fig.403).
 - (4) Adjust the guide tube to final swaging length (Ref. detail X of Fig. 403).
 - (5) Secure the support mandrel in a bench vice.

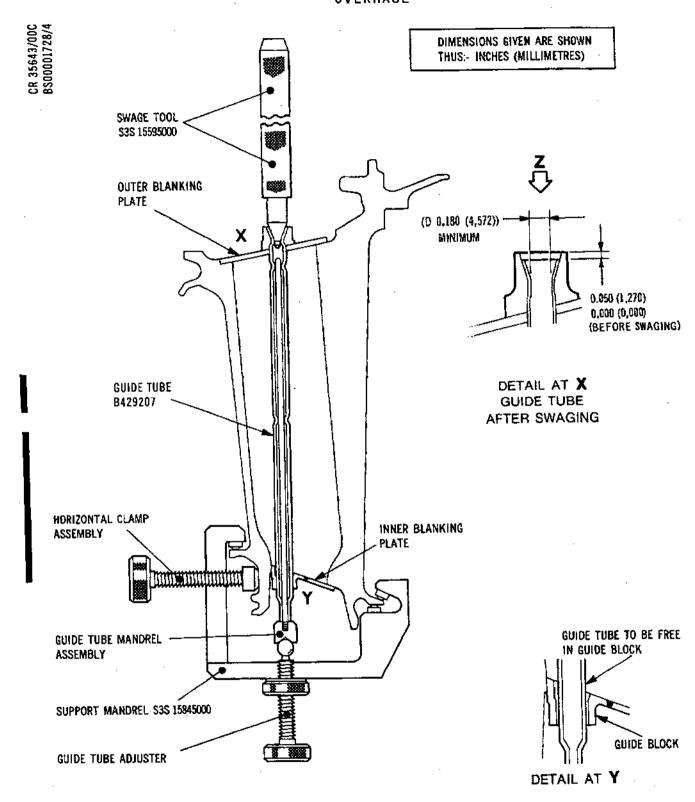
REPAIR

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Drilling to Remove Guide Tube Figure 402

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Guide Tube Details and Swaging Figure 403

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- (6) Using swage tool ref. tool item 4, swage the guide tube into position as shown in Fig. 403. There must be no end float.
- (7) Inspect the thermocouple guide tube internal diameter at the retaining block end to ensure minimum diameter of 0.180 in. (4,57 mm); refer to detail X of Fig. 403.
- (8) If necessary ream out the thermocouple guide tube to 0.1897/0.1890 in. (4,82/4,80 mm) diameter at retaining block end to a depth of 0.500 in. (12,70 mm) using reamer ref. tool item 5.
- (9) Remove the support mandrel from the bench vice and the vane from the support mandrel.
- (10) View to ensure satisfactory replacement of guide tube.
- (11) Test the vane for cracks using the fluorescent dye penetrant process specified for this component in 72-52-01, Inspection/Check.
- C. Identify.
 - (1) Mark SAL. B.478060 or R1 adjacent the standard part number, using the electro-chemical marking technique, Ref.72-09-00, Repair.
- D. Finally Inspect.
 - (1) Finally inspect the vane to ensure the repair has been carried out satisfactorily and that the vane is in a serviceable condition.
 - (2) Generally clean the vane to remove grease and foreign bodies, then place in a protective container and store as required.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u>Item No.</u> | <u>Fig.No.</u> |
|--------------------|----------|----------------|-----------------|----------------|
| Holding Fixture | 1 | \$3\$.15586000 | 1 | 401 |
| Piloted Drill | A/R | \$3\$.15844000 | 2. | 402 |
| Support Mandrel | 1 | \$3\$.15845000 | 3 | 403 |
| Swage Tool | 1 | S3S.15595000 | 4 | 403 |
| Reamer | A/R | S3S.15596000 | 5 | - |

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5. Replacement Parts

Description Quantity Part No. I.P.C. Fig./Item

Guide Tube 1 B.429207



LP TURBINE NOZZLE VANE - REPAIR REMOVAL AND REPLACEMENT OF BLANKING PLATES, RETAINING BLOCK, GUIDE BLOCK AND GUIDE TUBE

MODIFICATION NO.OL.8384C AND 8760C

1. Effectivity

| I.P.C. | Fig./Item | Part No. |
|----------|-----------|---------------------|
| 72-52-01 | 1 110A | B.927217, B.923112 |
| | 1 110B | B.932863 |
| | 1 110B | B.933354 |
| | 1 110c | в.933370 |
| | 1 1100 | B.933393, B.933392 |
| | 1 110b | B.934120 |
| | 1 110E | B.511083, B.511091, |
| | | B.511095, B.513812 |
| | 1 110F | B.515714, B.515718 |
| | | B.515722, B.517346 |
| | × | B.517347 |

2. Introduction

A. General

- (1) This repair describes the procedure for removing the guide tube, outer blanking plates, retaining block and guide block from a nozzle vane and replacing them.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.

REPAIR

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- (7) Surface texture is to be 125 micro inches (3,2 micrometers) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Place the component in a suitable container for protection against damage during transit between operations.

Instructions

- A. Remove Guide Tube
 - (1) Remove the thermocouple guide tube as instructed in Chapter 72-52-01 Repair No.1 or Repair No.6 as appropriate.
- B. Remove Blanking Plates, Retaining Block and Guide Block Assembly
 - (1) Remove inner and outer blanking plates, retaining block and guide block assembly using conventional hand tools, taking care not to damage the vane. If there is difficulty in removing the inner guide block assembly, use tooling as in operation (2)

NOTE: Do not use material with aluminium oxide on blanking plate abutment faces.

- (2) If there is difficulty in removing the inner guide block assembly, then use an electrical discharge machine with electrode ref. tool item 1, electrode holder ref. tool item 2 and filing block ref. tool item 3. Mount the vane in holding fixture ref. tool item 4. Refer to Chapter 72-09-23 Repair for machining procedure.
- (3) Dress the blanking plate and guide block assembly locations to remove the remains of the braze and produce a flat surface within the required surface finish. Take care not to remove more than 0.005 in. (0,13 mm) in achieving the required finish (Ref. Figure 401, 402 and Table 401).

REPAIR

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| SALVAGE NUMBER | PART NUMBER |
|----------------|-------------------|
| B.478061 | B.933354, B.93412 |
| | B.923112, B.51109 |
| B.478061A | B.927217, B.93286 |
| | B.933393, B.51571 |
| | B.515714, B.51572 |
| | B.517346, B.93337 |
| | B.933392, B.51109 |
| | B.511083, B.51734 |
| | B.513812 |

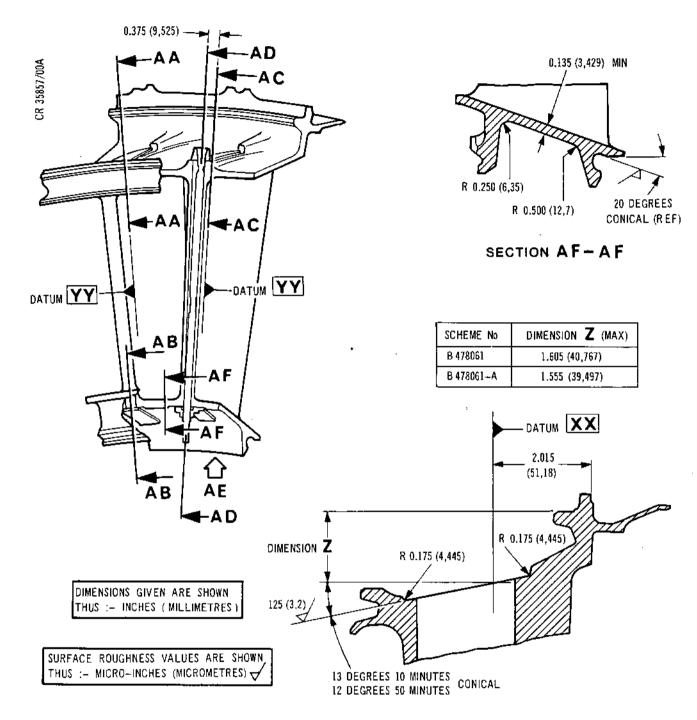
Salvage Number and Part Number Identification Table 401

REPAIR
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Repair No.2
Page 402A
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REPAIR
72-52-01
Repair No.2
Page 402B
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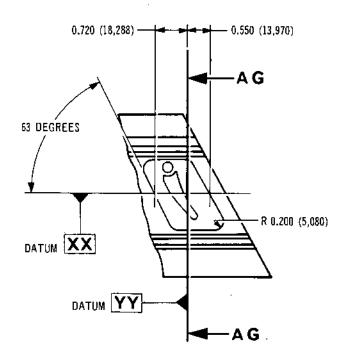


SECTION AA-AA (WITHOUT BLANKING PLATE)
SECTION AC-AC SIMILAR

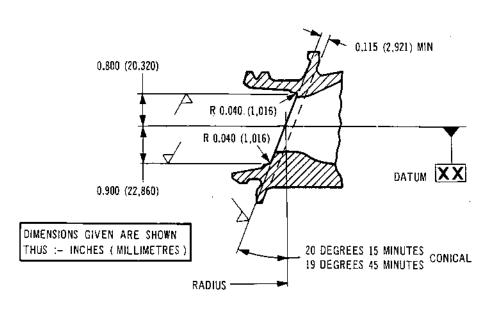
Blanking Plate Location Details Figure 401

72-52-01 Repair No.2 Page 403 Feb 1/82





VIEW IN DIRECTION OF ARROW AE (TUBE AND FITTING REMOVED) (SEE FIG 401)

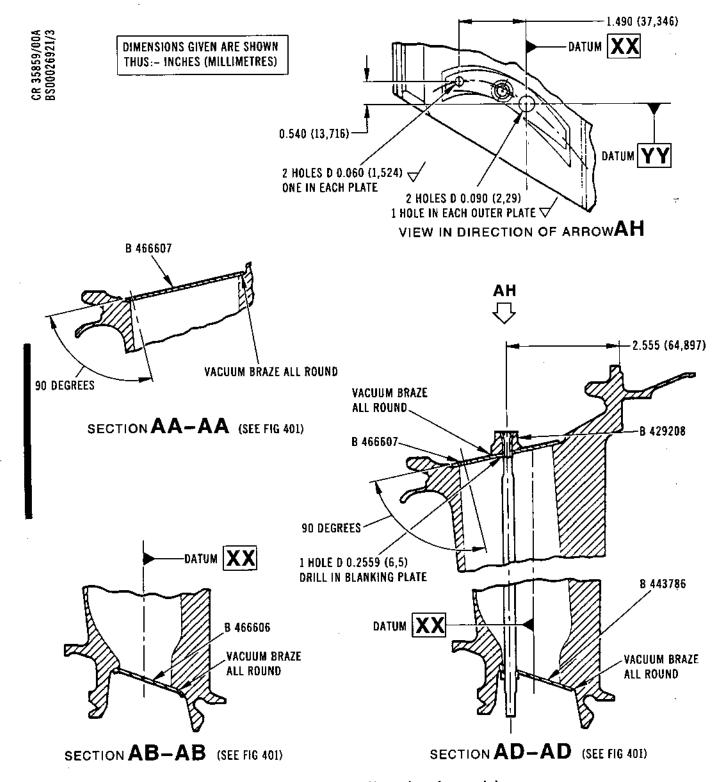


SECTION AG-AG

Blanking Plate Location Details Figure 402

> 72-52-01 Repair No.2 Page 404 Feb 1/82





LP Vane Nozzle Assembly Figure 403

REPAIR

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C. Inspect

- (1) Inspect for the satisfactory removal of blanking plates, retaining block, guide tube and guide block assembly.
- (2) Inspect for the complete removal of residual braze and pack aluminising from the inner and outer blanking plate, retaining block and guide block assembly locations.
- (3) Check the dimensions at the inner and outer blanking plate, retaining block and guide block locations.
- (4) Inspect the vane for cracks using the fluorescent dye penetrant procedure detailed for this component in Chapter 72-52-01 Inspection/Check.
- D. Nickel Plate Brazing Locations
 - (1) Withdraw from stores replacement blanking plates B.466606 and B.466607 (2 off), retaining block B.429208 and inner guide block assembly B.443786.
 - (2) Flash nickel plate the blanking plates, retaining block and inner guide block on the faces to be brazed only (Ref. Chapter 72-09-09 Repair).
 - (3) Flash nickel plate the blanking plate and inner guide block locations on the vane (Ref. Chapter 72-09-09 Repair).
- E. Assemble Outer Blanking Plates
 - (1) Assemble 2 off nickel plated blanking plates B466607 to the outer blanking locations on the vane, and tack weld into position.
 - (2) Vacuum braze the blanking plates to the vane. Work to TSD594, Overhaul Process 416, BS1845 NK4, using Nicrobraz 130.
- F. Inspect
 - (1) Inspect for the satisfactory completion of the brazing operation.
 - (a) Non-braze extending through the joint must not exceed 0.050 in. (1,27 mm) total length and 0.005 in. width on each plate.

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- (b) Cavitation, sinkage or shrinkage porosity is allowable provided there is continuous braze, except as in (a).
- (c) Excess braze alloy on adjacent surfaces is allowable provided it is adhering to the surface and not so extensive as to suggest poorly controlled technique.
- (2) Inspect the vane for cracks using the fluorescent dye penetrant procedure detailed for this component in Chapter 72-52-01, Inspection/Check.
- G. Machine Outer Blanking Plate Holes
 - (1) Screw electrode ref. tool item 5 into electrode extension ref. tool item 6, and clamp into electrode holder ref. tool item 7.
 - (2) Locate fixture ref. tool item 4 and electrode holder ref. tool item 7 to an electrical discharge machine, and align the electrode to the hole in the lower setting block.
 - (3) Locate the vane to the fixture and clamp lightly. Do not over-tighten the adjustable toggle clamp or distortion of the vane may occur.
 - (4) Lower the electrode through the vane, and produce a hole 0.2559 in. (6,500 mm) diameter in the outer blanking plate (Ref. Fig.401 and 403). Remove the vane from the fixture.
 - (5) Assemble drilling fixture ref. tool item 8 to the vane, and hand drill one hole 0.060 in. (1,52 mm) diameter in each outer blanking plate (Ref. Fig.403).
 - (6) Remove the drilling fixture.
 - (7) Any vanes which do not exhibit an aerofoil vent hole must have the 0.090 in. (2,29 mm) diameter hole drilled in the blanking plates as shown in Fig.403 using the following procedure:
 - (a) Drill to produce holes; one hole in each outer blanking plate.
 - (b) Remove burrs.
 - (8) Remove any burrs.

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REPAIR



H. Inspect

- (1) Inspect for the satisfactory completion of the machining operations.
- J. Assemble Retaining Block, Guide Block and Inner Blanking Plate
 - (1) Withdraw from stores the nickel plated retaining block B.429208, inner guide block assembly B.443786 and inner blanking plate B.466606.
 - (2) Assemble the retaining block in position on the outer blanking plate and tack weld to retain.
 - (3) Assemble the inner guide block in position using a slave guide tube 0.250 in. (6,35 mm) diameter, and tack weld in position.
 - (4) Assemble the inner blanking plate in position and tack weld to retain.

K. Inspect

(1) Inspect for the correct location of the retaining block, guide block assembly and inner blanking plate.

L. Braze

- (1) Coat the slave guide tube with green stop-off to prevent it becoming brazed to the vane.
- (2) Vacuum braze the retaining block, inner guide block assembly and inner blanking plate to the vane. Work to TSD594, Overhaul Process 416, BS1845 NK4, using Nicrobraz 130. Do not allow the slave tube to be brazed in.
- (3) Remove the slave tube, and clean up the vane.

M. Inspect

- (1) Inspect for the satisfactory completion of the brazing operation (Refer to paragraph 3F).
- (2) Inspect the vane for cracks using the fluorescent dye penetrant procedure detailed for this component in Chapter 72-52-01 Inspection/Check.

REPAIR



- N. Assemble Replacement Guide Tube
 - (1) Assemble guide tube B.429207 as instructed in Chapter 72-52-01, Repair No.1 or Repair No.6 as appropriate.
- P. Inspect Pack Aluminising
 - (1) Inspect the pack aluminising as instructed in Chapter 72-52-01, Inspection/Check.
- Q. Finally Inspect and Identify
 - (1) Mark SAL B.478061-A or R2 adjacent to the existing part number, using electro-chemical marking as instructed in Chapter 72-09-00, Repair.
 - (2) Finally inspect the vane to ensure that the repair has been carried out satisfactorily and that the vane is in a serviceable condition.

4. Special Tools, Fixtures and Equipment

| <u>Qty</u> | Tool No. | <u>Item</u> |
|------------|--------------------------------------|--|
| 1 | \$3\$.15588000 | 1 |
| 1 | S3S.15587000 | 2 |
| 1 | S3S.15589000 | 3 |
| 1 | S3S.15586000 | 4 |
| 1 | S3S.15592000 | 5 |
| 1 | \$3\$.15728000 | 6 |
| 1 | \$38.15591000 | 7 |
| 1 | s3s.15593000 | 8 |
| | <pre>Qty 1 1 1 1 1 1 1 1 1 1 1</pre> | 1 \$3\$.15588000 1 \$3\$.15587000 1 \$3\$.15589000 1 \$3\$.15586000 1 \$3\$.15592000 1 \$3\$.15728000 1 \$3\$.15591000 |

Replacement Parts

| <u>Description</u> | Qty | <u>Part No.</u> | <u>IPC</u> | <u>Fig/Item</u> |
|--------------------|-----|-----------------|------------|-----------------|
| Guide Tube | 1 | B.429207 | 72-52-01 | 1/112 |
| Blanking Plate | 2 | B.466607 | 72-52-01 | 1/114 |
| Blanking Plate | 1 | B.466606 | 72-52-01 | 1/115 |
| Retaining Block | 1 | B.429208 | 72-52-01 | 1/113 |
| Plate Assembly | 1 | B-443786 | 72-52-01 | 1/116 |



LP TURBINE NOZZLE VANE - REPAIR CRACKS BY WELDING

MODIFICATION NO. OL.8710C, 8752C AND 8778C

1. Effectivity

| I.P.C. | <u>Fig.</u> | /Item | Part No. |
|----------|-------------|-------|------------------------------|
| 72~52-01 | 1 | 80B | B.932860, B.933351 |
| | 1 | 80c | B.933364 |
| | 1 | 80b | B.515719 |
| | 1 | 90B | B.932861, B.933352 |
| | 1 | 90c | B.933366 |
| | 1 | 90 D | B.515720 |
| | 1 | 100B | B.932862, B.933353 |
| | - | 100c | B.933368 |
| | | 1000 | B.515721 |
| | | 110B | |
| | | 110c | B.933370 |
| | | 1100 | B.933392, B.933393, B.934120 |
| | | 110E | B.511091, B.513812 |
| | 1 | 110F | B.515722, B.517346, B.517347 |

Introduction

A. General.

- (1) This repair describes the procedure for the welding of cracks that have occurred in the nozzle vane.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair to all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Surface texture to be 125 micro-inches (32 micro-metres), unless otherwise stated.
- (7) Place the nozzle vane in a suitable protective container during transit between operations to avoid damage.

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REPAIR



| REPAIR LIMITATIONS (APPLICABLE TO BOTH VANES) | | | | |
|--|-------------------------------|--|--|--|
| CRACK LOCATION | MAXIMUM LENGTH OF CRACK | MINIMUM DISTANCE TO NEAREST CRACK | MAXIMUM No OF CRACKS PER VANE | |
| A OUTER FILLET RADIUS LEADING EDGE, MAY EXTEND INTO OUTER PLATFORM | 2.000 (50,80) | 0.500 (12,70) | 1 | |
| B OUTER FILLET RADIUS TRAILING EDGE MAY EXTEND INTO OUTER PLATFORM | 2.000 (50,80) | 0.500 (12,70) | 1 | |
| C INNER FILLET RADIUS TRAILING EDGE | 2.000 (50,80) | 0.500 (12,70) | 1 | |
| D LEADING EDGE EXCEPT WITHIN | 0.500 (12,70) | 0.250 (6,35) | 8 | |
| E TRAILING EDGE EXCEPT WITHIN | 1.500. (43,10) | 0.500 (12,70) | 4 | |
| F EXTENDING TOWARDS LEADING EDGE FROM VENT HOLE | 2,000 (50,80) | 1.000 (25,40) | 1 | |
| G LEADING EDGE IN CLOSE PROXIMITY. EXCEPT WITHIN AA | 0.750 (19,05) | _ | _ | |

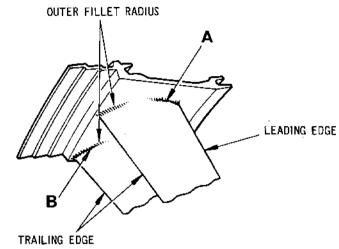
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

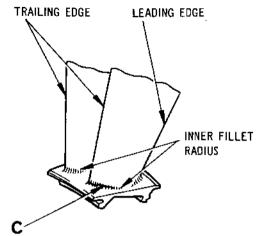
Repair Limitations Figure 401

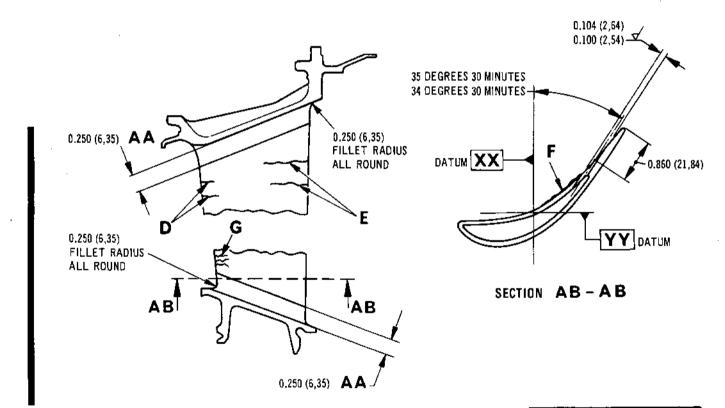
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DIMENSIONS GIVEN ARE SHOWN THUS :-- INCHES (MILLIMETRES)

Repair Limitations Figure 402

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- B. Repair Limitations.
 - (1) Repair limitations are shown in Figs. 401 and 402.

3. Instructions

- A. Prepare for Welding.
 - (1) Remove the blanking plates and guide tube (if applicable) to the appropriate repair; refer to Table 401.

| Nozzle Va | ne Part No. | Repair No. |
|-----------|--------------------------|---------------|
| B.932860 | Blanking Plates Only | R5 |
| B.932861 | Blanking Plates Only | R 5 |
| B.932862 | Blanking Plates Only | R 5 |
| B.932863 | Blanking Plates and | R2 |
| | Swaged Guide Tube | |
| B.933351 | Blanking Plates Only | R 5 |
| в.933352 | Blanking Plates Only | R 5 |
| B.933353 | Blanking Plates Only | R 5 |
| B.933354 | Blanking Plates and | R 2 |
| | Swaged Guide Tube | |
| в.933364 | Blanking Plates Only | R5 |
| B.933366 | Blanking Plates Only | R 5 |
| B.933368 | Blanking Plates Only | R 5 |
| B.933370 | Blanking Plates and | R2 |
| | Swaged Guide Tube | |
| B.933392 | Blanking Plates and | R2 |
| | Swaged Guide Tube | |
| B.933393 | Blanking Plates and | R2 |
| | Swaged Guide Tube | |
| B.934120 | Blanking Plates and | R2 |
| | Swaged Guide Tube | |
| B.511091 | Blanking Plates and Tack | R2 (B.Plates) |
| | Welded Guide Tube | R6 (Guide Tub |
| B.513812 | _ | R2 (B.Plates) |
| | Welded Guide Tube | R6 (Guide Tub |
| | Blanking Plates Only | R5 |
| B.515720 | | R5 |
| B.515721 | Blanking Plates Only | R 5 |
| B.517346 | - | R2 |
| | Swaged Guide Tube | |
| B.517347 | - | R2 (B.Plates, |
| | Welded Guide Tube | R6 (Guide Tul |

Removal and Replacement of Blanking Plates and Guide Tubes
Table 401

REPAIR

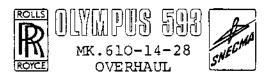
Dec 31/99

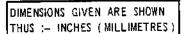
72-52-01 Repair No.3 Page 404



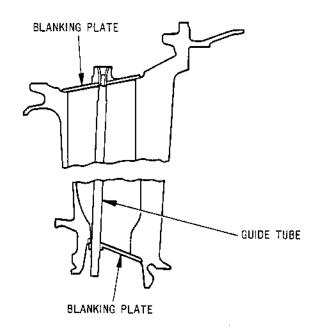
- (2) Remove pack aluminising; refer to Chapter 72-09-05 Repair, for relevant procedure.
- (3) Test the nozzle vane for cracks using the fluorescent dye penetrant technique specified for this component in Chapter 72-52-01 Inspection/Check.
- (4) Notch crack(s) for welding using simple carbide burr; refer to Fig. 403 for preparation details.
- B. Heat-treat and Weld Cracks.
 - (1) Heat treat as detailed in Chapter 72-09-28, Repair.
 - (2) Test the nozzle vane for cracks, using the flourescent dye penetrant process specified for this component in Chapter 72-52-07 Inspection/Check.
 - (3) Re-notch cracks if necessary.
 - (4) Weld cracks as detailed in Chapter 72-09-28, Repair, using welding chill ref. tool item 1.
 - (5) Finish the welds flush with existing contours. A variation of 0.003 in. (0,076 mm) maximum on the vane aerofoil above the basic shape is acceptable, all other surfaces are to be finished flush, hand grinding is permissible for dressing.
- C. Inspect.
 - (1) Test the nozzle vane for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-52-01 Inspection/Check.
 - (2) Carry out a non-destructive radiological (X-Ray) examination of the welded areas.
- D. Re-Notch and Heat Treat.
 - (1) Re-notch and heat treat if necessary, as detailed in Chapter 72-09-28, Repair.

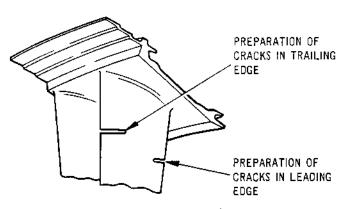
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CR 35412/00A





R 0.09375 (2,38)

TYPICAL WELD PREPARATION
DIAGRAM FOR CRACKS EXTENDING
INTO OUTER PLATFORM

TYPICAL WELD PREPARATION DIAGRAM FOR CRACKS IN VANE



WELD PENETRATION DIAGRAM FOR VANE



WELD PENETRATION DIAGRAM FOR CRACKS EXTENDING INTO OUTER PLATFORM

Weld Preparation Figure 403

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E. Inspect.

- (1) General.
 - (a) Inspect the nozzle for cracks using the procedure and the acceptance limits given in the following paragraph (2). If the nozzle meets the requirements of this inspection, proceed with the radiological examination and apply the added acceptance limits in accordance with paragraph (3).
- (2) Inspect the nozzle by the fluorescent dye penetrant crack detection method using the process specified for this component in 72-52-01, Inspection/Check. Apply the following acceptance limits.
 - (a) Aerofoil vent hole.
 - (i) Cracks up to 0.500 in. (12,70 mm) long extending from the vent hole are acceptable.
 - (b) Aerofoil (within permitted repair area at leading and trailing edges).
 - (i) Surface cracks are acceptable and may be blended out to a maximum depth of 0.015 in. (0,38 mm).
 - (ii) Two cracks up to 0.120 in. (3,05 mm) long are acceptable provided that they are at least 0.200 in. (5,1 mm) apart.
 - (iii) Five cracks up to 0.050 in. (1,30 mm) long are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.
 - (c) Fillet radii (within permitted repair area at leading and trailing edges).
 - (i) Cracks up to 0.080 in. (2,03 mm) are acceptable provided that they do not extend through the section or to within 0.320 in. (8,13 mm) of the leading or trailing edge.



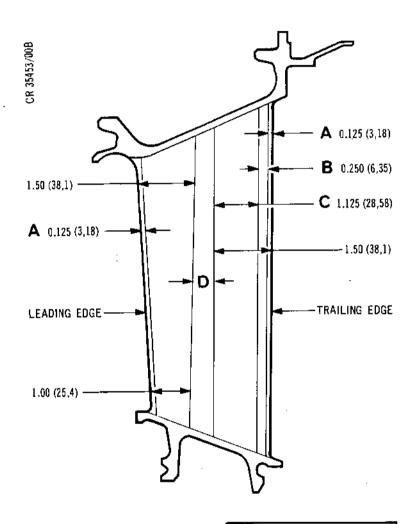
- (d) Inner and outer platforms (within permitted repair area).
 - (i) Two cracks up to 0.120 in. (3,05 mm) long are acceptable in each platform provided that they are at least 0.200 in. (5,1 mm) apart.
 - (ii) Five cracks up to 0.050 in. (1,30 mm) long are acceptable in each platform provided that they are at least 0.100 in. (2,50 mm) apart.
 - (iii) Two cracks up to 0.100 in. (2,50 mm) long which extend into the core by not more than the platform thickness are acceptable in each platform.
- (3) Inspect the nozzle by radiological (X-Ray) examination in accordance with the requirements of M.T.10 CAT.X using PFF/XT-1. Apply the following acceptance limits in conjunction with Figure 404.
 - (a) Area A.
 - (i) No cracks are acceptable.
 - (b) Area B.
 - (i) Cracks up to 0.050 in. (1,30 mm) long are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.

NOTE: A crack which extends from area B to area C or vice versa, is subject to the acceptance limits for area B.

- (c) Area C.
 - (i) One crack up to 0.250 in. (6,40 mm) long is acceptable.
 - (ii) Six cracks up to 0.100 in. (2,50 mm) long are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.

72-52-01
Repair No.3

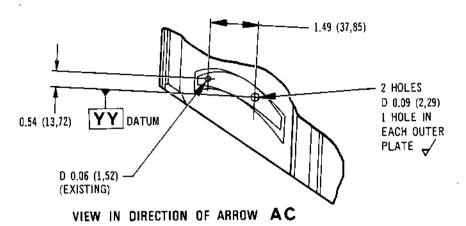
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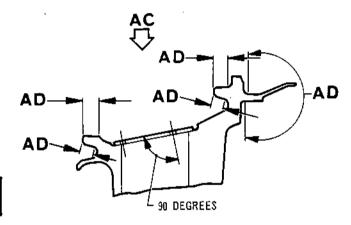


DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

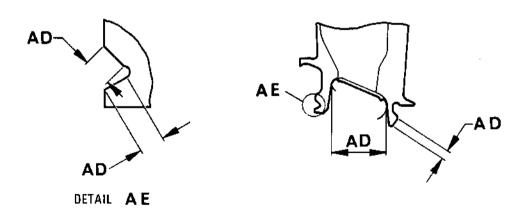
Radiological (X-Ray) Details Figure 404

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DIMENSIONS GIVEN ARE SHOWN Thus:- inches (Millimetres)



Drill and Pack Aluminising Details Figure 405

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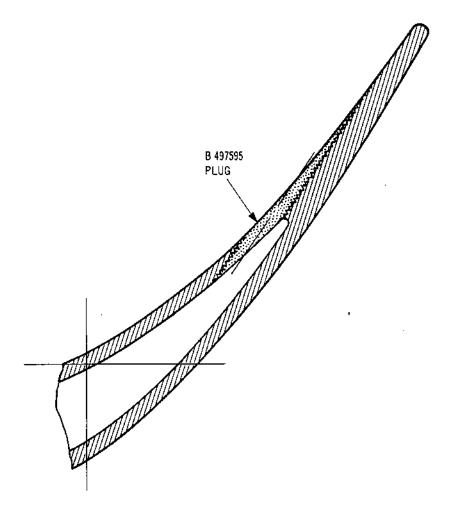
(d) Area D.

- (i) Any defects up to 0.020 in. (0,51 mm) diameter are acceptable.
- (ii) Defects up to 0.080 in. (2,03 mm) in the vane walls are acceptable provided that they do not extend through the section.
- (iii) Defects up to 0.360 in. x 0.120 in. (9,14 mm x 3,05 mm) in the vane walls are acceptable provided that they are at least 0.500 in. (12,70 mm) apart and there are no more than two such defects per vane.
- (iv) Defects up to 0.060 in. (1,52 mm) in the vane form are acceptable provided that they are at least 0.360 in. (9,14 mm) apart.

(e) General.

- (i) Tungsten inclusions and cavities up to 0.125 in. (3,18 mm) diameter are acceptable provided that they are at least 0.100 in. (2,50 mm) apart.
- (ii) Up to 15% loss of section in repair areas is acceptable.
- F. Open Out Existing Vent Hole.
 - (1) Where a plug has been previously fitted (Ref.Fig.406), ensure the acceptability of the brazing. If not acceptable, machine out the plug using electrodischarge machining. Remove burrs and sharp edges.
 - (2) If the plug has been removed, test the nozzie vane for cracks, using the fluorescent dye penetrant process specified for this component in Chapter 72-52-01 Inspection/ Check.





SECTION AB-AB
WITH PLUG FITTED (SEE FIG. 402)

Blanking Plug Figure 406

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G. Pack Aluminise.

(1) Pack aluminise the nozzle vane all over (including core), except within AD (Ref. Fig. 405). Refer to Chapter 72-09-05 Repair, for relevant procedure.

NOTE: Pack aluminising thickness to be 0.0015 to 0.003 in. (0,038 to 0,076 mm).

- H. Post Pack Aluminise Heat-treatment.
 - (1) Install the vane nozzle in a furnace and heat to a temperature of 900°C plus/minus 10°C, and soak at this temperature for 4 hours, then air cool.
- J. ' Replace Guide Tube and Blanking Plates.
 - (1) Replace the guide tube and blanking plates, (if applicable) to the appropriate repair; refer to Table 401.
- K. Drill Holes.
 - (1) Any vane in which the vent hole has been blanked off must have the 0.090 in. (2,29 mm) dia. hole drilled in the outer blanking plates as shown in Fig. 405, using the following procedure.
 - (a) Drill to produce holes, one hole in each outer blanking plate, as shown in Fig. 405.
 - (b) Remove burrs.



(c) Test the nozzle vane for cracks, using the fluorescent dye penetrant process specified for this component in Chapter 72-52-01 Inspection/ Check.

L. Identify.

(1) Mark salvage B.497462 or R3 close to the existing part number, using the electro-chemical marking technique as specified in Chapter 72-09-00 Repair. If cracks type F have been welded, the letter A must be marked after the repair number, e.g. B.497462-A.

M. Finally Inspect.

- (1) Finally inspect the nozzle vane assembly to ensure the repair has been carried out satisfactorily and the nozzle vane assembly is in a serviceable condition.
- (2) Generally clean the nozzle vane assembly to remove grease and foreign bodies, then place the assembly in a protective container and store as required.
- 4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | Tool No. | <u>Item</u> |
|--------------------|-----------------|----------------|-------------|
| Welding Chill | 1 | \$3\$.13614000 | 1 |

Replacement Parts

None Required.



LP TURBINE NOZZLE VANE - REPAIR RESTORATION OF FRONT AND REAR LOCATION FEET USING WELD APPLIED STELLITE 12

MODIFICATION NO. OL.8770C

1. Effectivity

| I-P-C. | Fig./Item | Part No. |
|----------|-----------|-------------------|
| 72-52-01 | 1 80в | в.932860 в.933351 |
| | 80c | B.933364 |
| | 800 | B.515719 |
| | 908 | B.932861 B.933352 |
| | 90c | в.933366 |
| | 900 | в.515716 в.515720 |
| | 100B | B.932862 B.933353 |
| | 100c | в.933368 |
| | 1000 | B.515721 |
| | 110B | B.932863 B.933354 |
| | 110c | в.933370 |
| | 1100 | B.933393 B.934120 |
| | , , , , | B.933392 |
| | 110E | в.513812 |
| | 110F | B.515722 B.517346 |

2. <u>Instructions</u>

- A. Inspect.
 - (1) Inspect nozzle vane prior to despatch to Turbine Services Ltd.
- B. Despatch for Repair.
 - (1) Despatch nozzle vane to Turbine Services Ltd. for necessary repair work to restore the front and rear location feet using weld applied stellite 12.
- C. Finally Inspect.
 - (1) Inspect nozzle vane on return from Turbine Services Ltd. to ensure repair work has been carried out satisfactorily and the vane is in a serviceable condition.
 - (2) Check to ensure vane has been identified with the repair number SAL.B.499430-1 or R4 adjacent the existing part number, if not, identify using the electro-chemical or vibro-percussion marking method detailed in Chapter 72-09-00, Repair.

REPAIR

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LP TURBINE NOZZLE VANE - REPAIR REPLACEMENT OF BLANKING PLATES MODIFICATION NO. 0L.8747C

1. Effectivity

| <u>ipc</u> | Fig./Item | Part No. |
|------------|-----------|-----------------------------|
| 72-52-01 | 1 80A | в927249, в923109 |
| | 1 80B | B932860 |
| | 1 80B | B933351 |
| | 1 80C | B933364 |
| | 1 80 D | B515719, B515711, |
| | | B515715 |
| | 1 90A | B927233, B923110 |
| | 1 90в | B932861 |
| | 1 90B | в933352 |
| | 1 90C | В933366 |
| | 1 90 b | B515720, B515712, |
| | | B515716 |
| | 1 100A | B927201, B923111 |
| | 1 100B | в932862 |
| | 1 100B | в933353 |
| | 1 100c | в933368 |
| | 1 1000 | B515721, B515713 B515717 |

2. Introduction

A. General.

- (1) This repair describes the procedure for removing the blanking plates from a nozzle vane and replacing them.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.

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- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micrometres).
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. <u>Instructions</u>

- A. Remove Blanking Plates.
 - (1) Remove the inner and outer blanking plates using conventional hand tools. Take care not to damage the vane, particularly the blanking plate locations.
 - (2) Dress the blanking plate locations to remove the remains of braze and produce a flat surface within the required surface finish. Care must be taken not to remove more than 0.005 in. (0,13 mm) in achieving the required finish (Ref.Fig.401 and Table 401). Do not use materials, containing aluminium oxide.

| SALVAGE NO. | PART NUMBER |
|-------------|---|
| B.478063 | B.933351-3, B.923109-11 |
| B.478063A | B.932860-2, B.927249 B.933364, B.933366 B.933368, B.515719 B.515720, B.515721 B.515711, B.515712 B.515713, B.515715 B.515716, B.515717 B.927201, B.927233 |

Salvage Number and Part Number Identification Table 401

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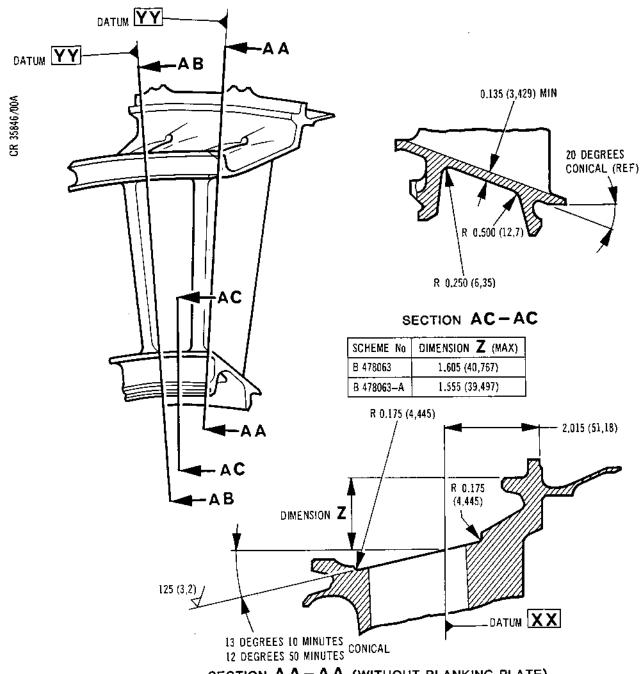
- (3) Remove burrs and sharp edges.
- B. Inspect.
 - (1) Inspect for the satisfactory removal of the blanking plates.
 - (2) Inspect the vane for cracks using the fluorescent dye penetrant procedure detailed for this component in Chapter 72-52-01, Inspection/Check.



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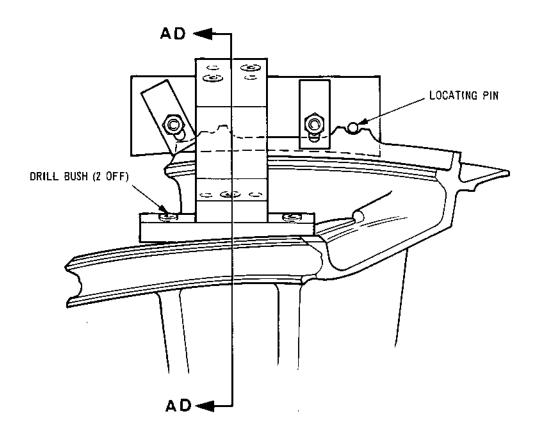
SECTION AA-AA (WITHOUT BLANKING PLATE)
SECTION AB-AB SIMILAR

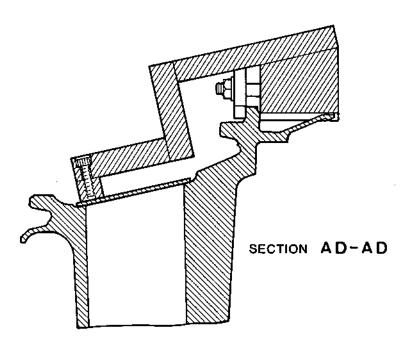
SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Blanking Plate Location Details Figure 401

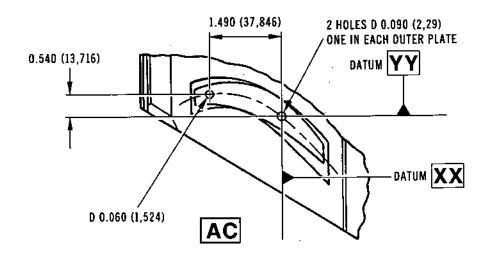
> 72-52-01 Repair No.5 Page 403 Feb 1/82

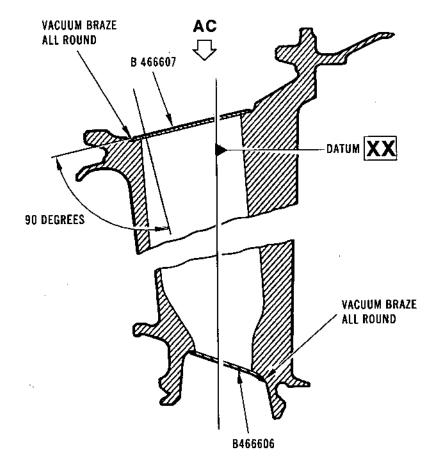




Drilling Fixture Ref. Tool Item 1 Figure 402

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SECTION AA-AA (SEE FIG 401)
SECTION AB-AB SIMILAR

DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

Blanking Plate Assembly and Drilling Figure 403

REPAIR

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- C. Nickel Plate Brazing Locations.
 - (1) Withdraw from stores replacement blanking plates B.46606 (2 off per vane) and B.466607 (2 off per vane).
 - (2) Inspect for the complete removal of residual braze and pack aluminising from the blanking plate locations.
 - (3) Check the dimension at the blanking plate locations.
 - (4) Flash nickel plate the blanking plates on the side to be brazed only (Ref.72-09-09, Repair).
 - (5) Flash nickel plate the blanking plate locations on the vane assembly (Ref.72-09-09, Repair).
- D. Assemble Blanking Plates.
 - (1) Assemble the nickel plated blanking plates to the vane and tack weld in position.
 - (2) Vacuum braze the blanking plates to the vane. Work to TSD594, Overhaul Process 416, BS1845 NK4, using Nicrobraz 130.

E. Inspect.

- (1) Inspect for the satisfactory completion of the brazing operation.
 - (a) Non-braze extending through the joint must not exceed 0.050 in. (1,27 mm) total length and 0.005 in. (0,13 mm) in width on each plate.
 - (b) Cavitation, sinkage or shrinkage porosity is allowable provided there is continuous braze except as in (a).
 - (c) Excess braze alloy on adjacent surfaces is allowable provided it is adhering to the surface and not so extensive as to suggest poorly controlled technique.
- (2) Inspect the vane for cracks using the fluorescent dye penetrant procedure detailed for this component in Chapter 72-52-01, Inspection/Check.

REPAIR

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F. Drill.

- (1) Assemble the drill jig ref. Tool Item 1, as shown in Fig. 402.
- (2) Drill 2 holes 0.060 in. (1,52 mm) diameter in the outer blanking plates (Ref.Fig.402).
- (3) Any vanes which do not exhibit an aerofoil vent hole must have the 0.090 in. (2,29 mm) diameter hole drilled in the blanking plates as shown in Fig.403.
- (4) Remove any burrs.
- G. Inspect.
 - (1) Inspect for the satisfactory completion of the `drilling operation.
 - (2) Inspect the pack aluminising as instructed in Chapter 72-52-01 Inspection/Check.
- H. Finally Inspect and Identify.
 - (1) Mark SAL B.478063 or R5 adjacent to the standard part number using electro-chemical marking (Ref.72-09-00, Repair).
 - (2) Finally inspect the vane to ensure that the repair has been carried out satisfactorily, and that the vane is in a serviceable condition.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | <u>Quantity</u> | <u>Tool No.</u> | <u>Item</u> |
|--------------------|-----------------|-----------------|-------------|
| Fixture | 1 | s3s.15593000 | 1 |

5. Replacement Parts

| <u>Description</u> | Quantity | <u>Part No.</u> |
|--------------------|----------|-----------------|
| Blanking Plate | 2 | B.466606 |
| Blanking Plate | 2 | B.466607 |

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Repair No.5
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LP TURBINE NOZZLE VANE - REPAIR REMOVAL AND REPLACEMENT OF TACK WELDED GUIDE TUBE

MODIFICATION NO. 8933C

1. Effectivity

| I.P.C. | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|---|
| 72-52-01 | 1 110E | B.511083, B.511091, B.511095, B.513812 |
| | 1 110F | B.517347 |

2. Introduction

A. General

- (1) This repair describes the procedure for removing and replacing tack welded guide tubes in the LP turbine nozzle guide vanes.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.



- (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

3. <u>Instructions</u>

- A. Remove Guide Tube (Ref. Fig. 401)
 - (1) Using a hand drill with a drill bit 0.234 in. (5,95 mm) diameter, release the guide tube from the outer blanking plate by drilling out the swaged part of the tube. Care must be taken not to damage existing parts. Pull out the remains of the tube through the inner end of the vane assembly.
 - (2) Remove the swaged and tack-welded part of the guide tube by grinding through the tack welds. Parent material must not be removed.
 - (3) Dress to clean up the outer and inner tube locations, and remove any swarf from inside the vane.

B. Inspect

- (1) Inspect for the satisfactory removal of the guide tube.
- (2) Inspect the vane for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-52-01 Inspection/Check.
- C. Assemble Guide Tube (Ref. Fig. 401)
 - (1) Withdraw from stores a new guide tube part number B.511084.
 - (2) Insert the tube through the vane guide block and locate the shouldered end in the vane retaining block.

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Thermocouple Guide Tube Assembly Figure 401

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- (3) Check that the tube is correctly located in the vane, and assemble the support mandrel ref. tool item 1 to the vane.
- (4) Secure the support mandrel ref. tool item 1 in a bench vice.
- (5) Adjust the guide tube to final swaging length (Ref. detail X of Fig. 401).
- (6) Using the swage tool ref. tool item 2, swage the guide tube in position. There must be no end float.

p. Tack Weld

(1) Tack weld the end of the guide tube to the retaining block in three places (Ref. Fig. 401) as instructed in TSD 594 OP 409, using filler rod MSRR 9500/3 (OMat 305).

E. Inspect

- (1) Inspect the welded areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-52-01 Inspection/Check.
- (2) Inspect thermocouple guide tube internal diameter at the retaining block end to ensure minimum diameter of 0.180 in. (4,57 mm); refer to detail X of Fig.401.

F. Ream

(1) If necessary ream out the thermocouple guide tube to 0.1897/0.1890 in. (4,82/4,80 mm) diameter at the retaining block end to a depth of 0.50 in. (12,70 mm) using reamer ref. tool item 3.

G. Inspect

- (1) Inspect for the satisfactory replacement of the guide tube.
- (2) Inspect the vane for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-52-01 Inspection/Check.

H. Identify

(1) Mark SAL B.511466 or R6 adjacent to the existing part number using vibro-percussion engraving as instructed in Chapter 72-09-00 Repair.

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J. Final Inspection

- (1) Finally inspect the vane to ensure that the repair has been carried out satisfactorily and that the vane is in a serviceable condition.
- (2) Generally clean the vane to remove grease and foreign bodies, and place in a protective container.

4. Special Tools, fixtures and Equipment

| <u>Description</u> | Qty. | Tool No. | <u>Item</u> |
|--------------------|------|----------------|-------------|
| Support Mandrel | 1 | \$3\$ 15845000 | 1 |
| Swage Tool | 1 | \$3\$ 15595000 | 2 |
| Reamer | 1 | \$3\$ 15596000 | 3 |

5. <u>Replacement Parts</u>

| <u>Description</u> | Qty. | Part No. | IPC Ref. |
|--------------------|------|----------|----------------|
| Guide Tube | 1 | B.511084 | 72-52-01/1-112 |



NOZZLE VANE SUPPORT DIAPHRAGM ASSEMBLY - REPAIR REPLACEMENT OF DAMAGED NO.24 AND 25 LABYRINTH RINGS

REPAIR NO.B513548

1. Effectivity

| I.P.C. | Fig | ./Item | Part No. |
|----------|-----|--------------|--------------------|
| 72-52-01 | 1 | 120A 120B | B922600 B927801 |
| | 1 | 120C | в933278 |

2. Introduction

A. General.

- (1) This repair describes the procedure for the replacement of damaged No.24 and 25 labyrinth seals fitted to the LP Turbine Nozzle Vane Support Diaphragm Assembly.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Tolerances on machined angles are plus/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of these repairs should be achieved without deviation. Where a need to deviate is considered necessary, agreement should first be sought from the Repair Authority.
- (2) Refer to Figure 401. This repair may be embodied any number of times provided that the diameter of bore AB is not greater than 17.004 in. (431,90 mm) and the diameter of bore AC is not greater than 13.0035 in. (330,29 mm).

REPAIR

72-52-01

3. Instructions

A. Preparation.

(1) Refer to Figure 402. Using conventional hand tools, carefully remove defective rings as necessary from bore AB and bore AC.

B. Inspect.

- (1) Refer to Figure 401. Check the diameters of bores AB and AC.
- (2) Carry out crack detection check on repair area using procedure specified for this component at Chapter 72-52-01, Inspection/Check.

C. Assemble.

- (1) Refer to Figure 402 and this instruction para.5, Replacement Parts.
- (2) Fit items 3 and 4 in bore AB and items 1 and 2 in bore AC using liquid nitrogen to freeze the new components before assembly.

D. Inspect.

(1) Referring to Figure 402, examine the component to ensure new labyrinth rings are correctly fitted.

E. Machine.

- (1) Fill the gaps between the rings in both sets with Wilkins Campbell wax (Omat 228), ensuring complete application and adhesion.
- (2) Refer to Figure 402. Mount the component on a grinding machine and set true to datum A.
- (3) Finish machine the bores AD and/or AE to the dimensions shown.
- (4) Deburr labyrinth rings and remove the soft wax.
 NOTE: Ensure all holes are free from wax.

F. Clean.

(1) Wash component with high pressure paraffin jet.

REPAIR

72-52-01



G. Inspect.

- (1) Refer to Figure 402. Check the dimensions of bores AD and AE.
- (2) Carry out crack detection check on repair area using procedure specified for this component at Chapter 72-52-01, Inspection/Check.

H. Identify.

- (1) Mark the component SAL B513548 adjacent to the existing part number using vibro-percussion engraving marking as specified in Chapter 72-09-00, Repair.
- J. Final Inspection.
 - (1) Inspect the component to ensure that the repair has been completed satisfactorily and that the LP Turbine Nozzle Vane Support Diaphragm Assembly is serviceable.
- 4. Special Tools, Fixtures and Equipment

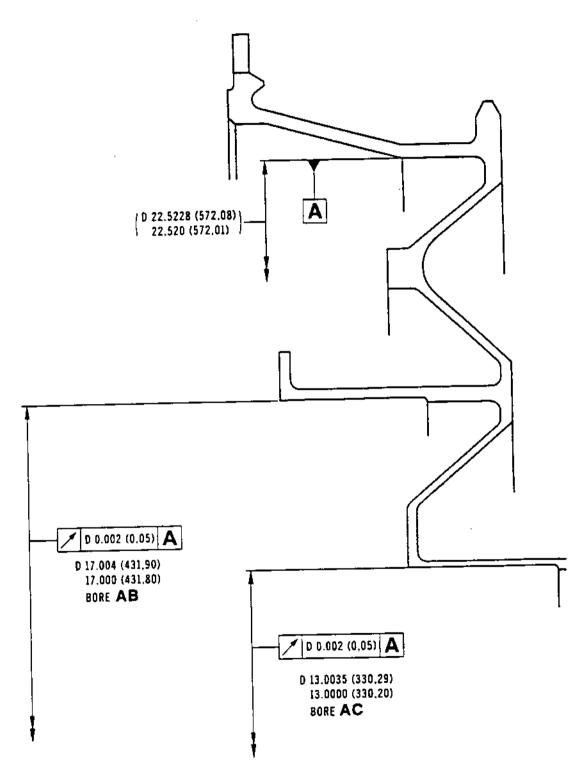
None.

5. Replacement Parts

| Part Number | Component | Item Number |
|-------------|----------------|-------------|
| B349487 | RING LABYRINTH | 1 |
| B349488 | RING LABYRINTH | 2 |
| B349489 | RING LABYRINTH | 3 |
| B349490 | RING LABYRINTH | 4 |

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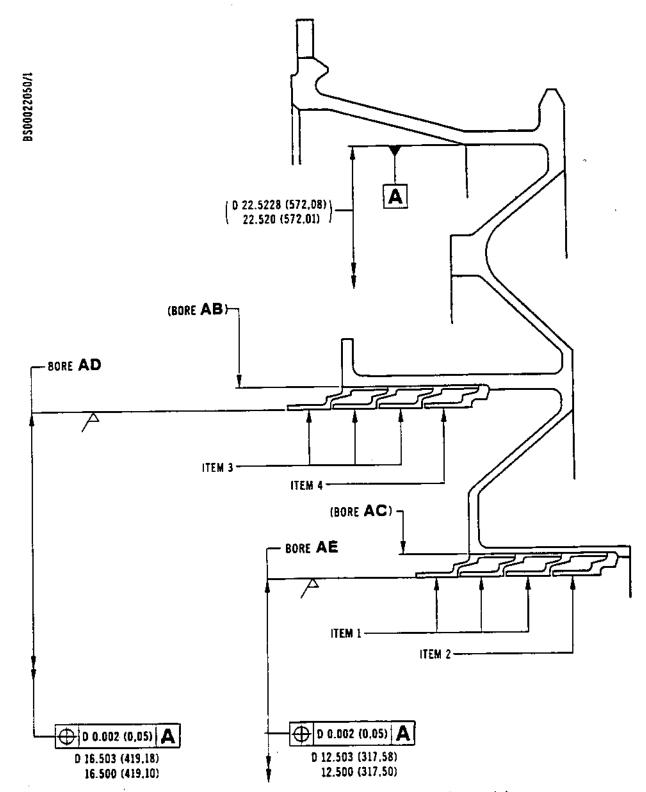


Nozzle Vane Support Diaphragm Assembly Figure 401

REPAIR

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Nozzle Vane Support Diaphragm Assembly Figure 402

REPAIR

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VANE A/O NOZZLE TURBINE L.P. RESTORATION OF CRACKED OUTER BLANK PLATES.

REPAIR NO. B513545

1. EFFECTIVITY.

| IPC | Fig./Item | Part No. |
|----------|-----------------|----------|
| 72-52-01 | 01 080A | в927249 |
| | 01 0808 | B932860 |
| | 01 080c | В933364 |
| | 01 090A | B927233 |
| | 01 090B | B932861 |
| | 01 09 0¢ | B933366 |

2. REPAIR LIMITATIONS.

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

- a) Cracking should only be in the braze securing the outer blank plates.
- b) The edges of the crack must be "tight" and there should be no evidence of lifting of the plate. Plate lift indiactes that it must be replaced.
- c) Any number of cracks may be repaired.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR



4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Keller the Blank Plate locally to form a slight step (0.030 max).

Vane material not to be impaired in the two areas where the Blank Plate overlaps the shroud.

Refer fig 401

 Using a small cutter dress away the braze fillet around the plate.

NOTE: Grinding methods not permitted.

3) Inspect for cracking.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

4) Vapour degrease component.

Refer Overhaul Manual Chapter 72-09-00 Cleaning

5) Vacuum furnace re-braze all around the blank plate. Braze at a temperature of 1050 - 1100°C in a vacuum of 1 - 5 x 10-4 Torr.

Refer TSD 594-416 Use Nicrobraze 130 or Endewrance CM.52 powder. Ref. MSRR 9500/114.

6) Inspect for satisfactory brazing.

TSD 594-416.

7) Inspect for cracks all over.

Refer Overhaul Manual Chapter 72-52-01 Inspection/check

8) Mark on SAL B513545 or R8 adjacent to existing part number using vibro-percussion engraving. Refer Overhaul Manual Chapter 72-09-00 Repair

4. MATERIAL

COMPONENT

MATERIAL.

RR CODE.

VANE A/O NOZZLE TURBINE L.P. NICKEL BASED ALLOY MSRR 7138 QJD

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6. DATA

NONE

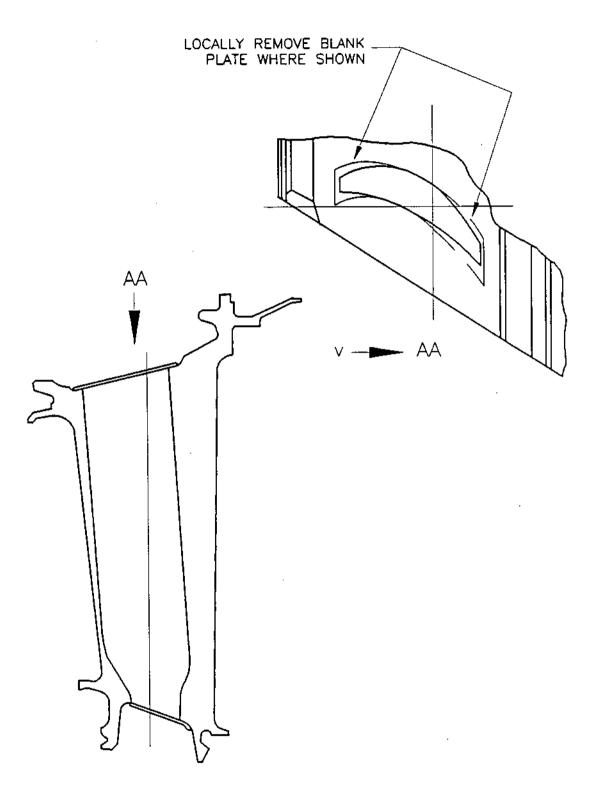
7. <u>TOOLS</u>

NONE

8. REPLACEMENT PARTS

NONE





GENERAL SECTION THRU LPT NGV FIG.401

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DIAPHRAGM, ASSEMBLY OF, NOZZLE VANE SUPPORT

RESTORE VANE LOCATING SLOTS BY WELDING

REPAIR NO. B513549

1. EFFECTIVITY

| IPC | Fig./Item | PART No. |
|----------|-------------------------------|-------------------------------|
| 72-52-01 | 01 120A 01 120B 01 120C | B922600 B927801 B933278 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Maximum depth of fretting wear repairable 0.038(0.96) to either one or both slot faces.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Thoroughly clean and prepare for Refer TSD 594 OP 409 welding.

72-52-01 Repair No. 9 Page 401 Dec 1/91 2) Weld build-up side faces of slots as required, apply sufficient weld to obtain finished dimensions. Take precautions to prevent distortion. Refer TSD 594 OP 407 method 2. Use filler rods MSRR 9500/15. Refer fig.401, 402 and 403.

3) Crack detect all over.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check.

 4) Position assembly on suitable machine and set true.
 Machine to reproduce finished dimensions. Refer fig.401 and 402.

5) Hand dress to remove any excess weld flush with adjacent surfaces. Use conventional hand tools. Do not impair adjacent surfaces. Refer fig.403.

6) Dimensionally inspect.

Refer fig.401, 402 and 403

. 7) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check.

8) Mark SAL B513549 or R9 adjacent to existing part number, using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

DIAPHRAGM, ASSEMBLY OF, NOZZLE VANE SUPPORT.

WASPALOY MSRR7034 QDY

6. DATA

NONE.

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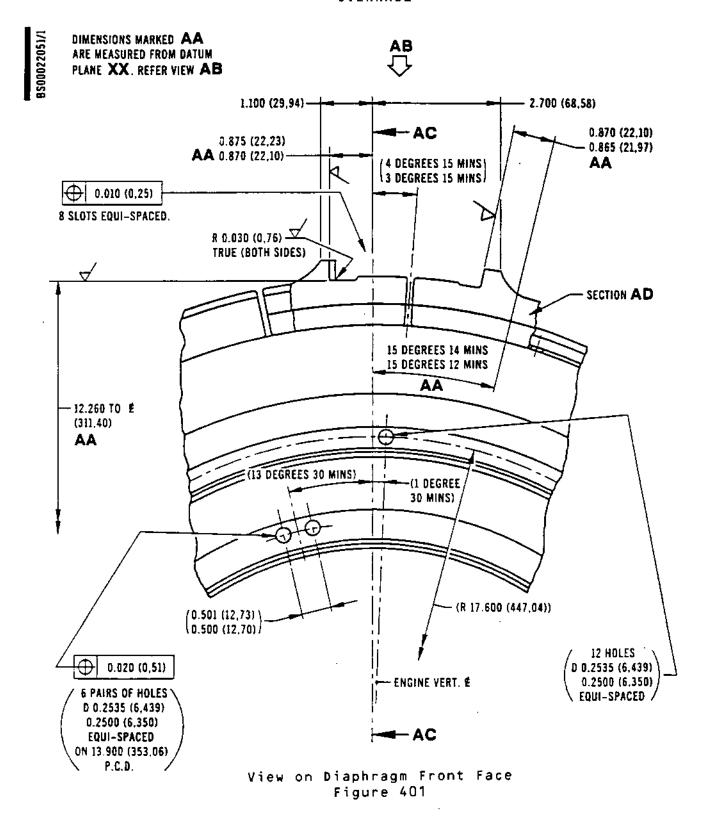
7. <u>TOOLS</u>

NONE.

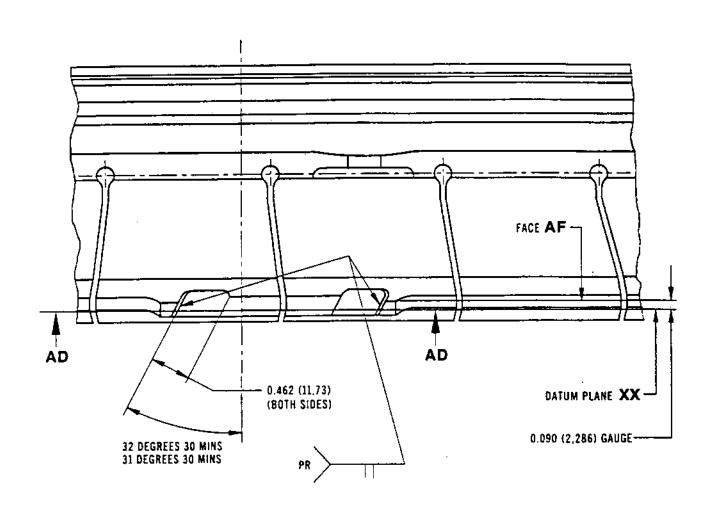
8. REPLACEMENT PARTS

NONE.

REPAIR
72-52-01
Repair No.9
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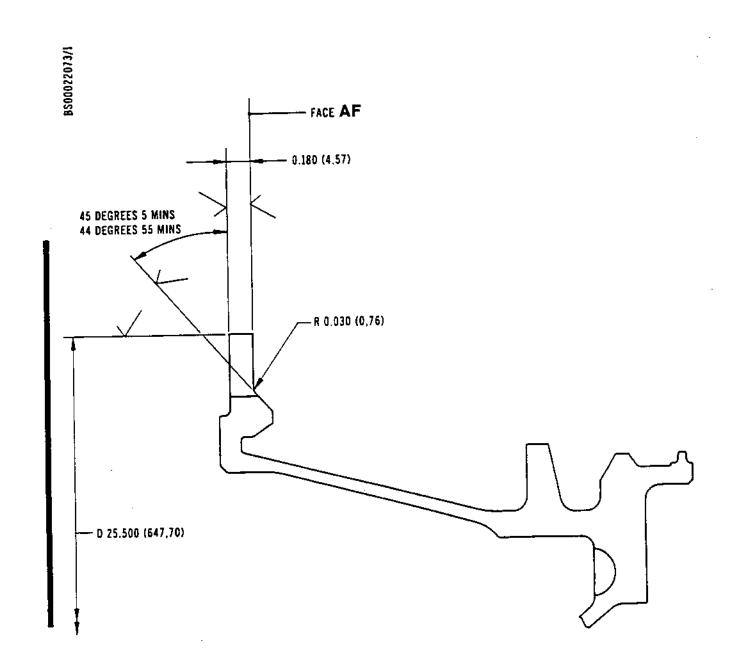
REPAIR 72-52-01 Repair No.9 Page 404 Dec 30/98 BS00022052/1



View AB Figure 402

REPAIR

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Section AC Figure 403

REPAIR 72-52-01 Repair No.9 Page 406 Dec 30/98



PIAPHRAGM, ASSEMBLY OF, NOZZLE VANE SUPPORT REPAIR OF FRETTED FRONT AND/OR REAR STATOR SUPPORT FACES BY WELDING.

REPAIR NO. B492927-28

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-52-01

B916177, B922579 B922600, B922790 B922791, B927801 B927823, B927824

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

This repair is divided into 2 parts:-

Sal.B492927 - Repair of fretted rear concave face, (Refer fig. 403 detail B) by welding using Stellite 12 filler rod.

Sal.B492928 - Repair of fretted front bevelled face(s), (Refer fig.402 detail A) by welding using Stellite 12 filler rod.

NOTE: If both parts of this repair are applied simultaneously only one heat treatment is required after final machining.

Post-weld distortion in the 24 vane 'fingers' (Refer fig.404) up to 0.100 (2,54) maximum, may be corrected by manipulation.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR

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4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Dimensionally inspect both labyrinth ring bores in relationship to Daum A bore, prior to commencing repair(s). Refer fig.405

- 2) Inspect and verify areas of fretting. Proceed to B492927 and/or B492928 of this repair instruction as appropriate.
- 4.1.Sal B492927 Repair of fretted rear concave face (Refer fig. 403 Detail B) by welding using Stellite 12 filler rod.
- Locate diaphragm to a suitable Machining Fixture locating on datum 'A'.

Refer Para.7 Tools, Item 1

- Locate Machining Fixture to a suitable machine and set true.
- 3) Machine to pre-welding dimensions.

Refer fig. 403

NOTE: For repeat repairs to this location, remove minimum depth of previous deposition - sufficient to remove evidence of pitting caused by fretting.

OPTIONAL (repeat repairs only)

Visually inspect for degree of fretting.

Provided it is practical to do so, hand dress using conventional hand tools to remove pitting (if required).

NOTE: Where pitting is not present and fretting is of a uniform nature, omit operations 1) to 3) and proceed to operation 4).

4) Dimensionally inspect.

Refer fig.403

REPAIR



5) Thoroughly clean and prepare for welding. Refer TSD 594-409.

Locally crack detect repair area. Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

7) Manual inert gas arc weld build-up. Ensure sufficient thickness is applied to achieve intermediate machining Refer TSD 594-407 Method 3 Filler rods to MSRR 9500/15 (OMat 311). Refer fig.403

NOTE: For repeat repairs, ensure sufficient thickness is applied to clean up on final machining then proceed to operation 12).

Refer TSD 594-407 Method 2 in lieu of Method 3.

8) Load diaphragm to Machining Fixture, locating on datum 'A'. Refer Para.7 Tools, Item 1

- Locate Machining Fixture to a suitable machine and set true.
- 10) Machine to intermediate weld dimensions.

Refer fig.403

11) Locally crack detect repair area. Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

12) Dimensionally inspect.

Refer fig.403

13) Manual inert gas arc weld build-up. Ensure sufficient thickness is applied to clean up on final machining.

TSD 594-407 Method 3. Filler rods to MSRR 9500/15. Refer fig.401 and 403

14) Locally crack detect repair area.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

15) Load diaphragm to Machining Fixture, locating on datum 'A'. Refer Para.7 Tools, Item 1

- 16) Locate Machining fixture to a suitable machine and set true.
- 17) Finish machine. Refer fig.401

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18) Locally crack detect repair area.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

- a) If cracking is detected, weld correct using operations 19) to 22).
- b) If cracking is not detected, proceed to operation 23).
- 19) Vee-groove to remove crack(s). Remove minimum material.
- 20) Manual inert gas arc weld prepared area(s). Ensure sufficient thickness is applied to permit location face to be dressed back to final dimensions.

TSD 594-407 Method 2. Filler rods to MSRR 9500/15 (OMat 311). Refer fig.401 and 403

21) Hand dress back to required final profile. Use conventional hand tools, do not impair parent material. Refer fig.401

22) Locally crack detect repair area.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

23) Crack detect all over.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

24) Dimensionally inspect.

Refer fig. 401

25) Mark SAL.B492927 or R10A adjacent to existing part number, using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair Refer fig.401 for identity location.

- 4.2.Sal B492928 Repair of fretted front bevelled face(s), (Referfig.402 Detail A) by welding using Stellite 12 filler rod.
- Visually inspect degree of fretting.

NOTE: Where pitting is not present and fretting is of a uniform nature, omit operation 2 and 3) and proceed to operation 4).

Hand dress using conventional hand tools to remove pitting.

OPTIONAL METHOD

Load diaphragm to Machining Fixture, locating on datum 'A'.

Locate Machining Fixture to a suitable machine, and set true.

Machine to remove pitting from existing face(s). Remove minimum amount of previous deposition.

- 3) Dimensionally inspect.
- 4) Thoroughly clean and prepare for welding.
- 5) Locally crack detect repair area.
- 6) Manual inert gas arc weld build up. Ensure sufficient thickness is applied to clean up on final machining.
- 7) Dimensionally inspect for distortion at the edges of the 24 'fingers' and runout on the front face.

Refer Para.7 Tools, Item 1

Refer fig.402

Refer fig.402

Refer TSD.594-409.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

TSD 594-407 Method 2. Filler rods to MSRR 9500/15 (OMat 311). Refer fig.401

Refer fig.402 and 404

REPAIR

8) Provided that the run on the front face of each finger is no greater than 0.005 (0,13) and the distortion at the edge of each finger is within +0.050 (1,27) to -0.030 (0,76) of original bore diameter then accept and proceed to operation 10).

Refer fig.404

9) If runout and/or distortion is outside stated limits, manually manipulate 'fingers' to within acceptable limits stated above. Refer fig.404 for maximum correctable distortion and fig.402

10) Locally crack detect repair area.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

11) Load diaphragm to Machining Fixture, locating on Datum 'A'.

Refer Para.7 Tools, Item 1

- 12) Locate Machining Fixture to a suitable machine and set true.
- 13) Finish machine.

14) Locally crack detect repair

area.

 a) If cracking is detected, correct using operations 15) to 21).

b) If cracking is not detected, proceed to operation 22).

15) Vee-groove to remove crack(s). Remove minimum material.

16) Manual inert gas arc weld prepared area(s). Ensure sufficient thickness is applied to permit location faces to be dressed back to dimensions.

17) Dimensionally inspect for distortion at the edges of the 24 'fingers and runout on the front face. Refer fig.401

Refer Overhaul Manual Chapter 72-52-01 Inspection/check

TSD 594-407 Method 2. Filler rods to MSRR 9500/15 (OMat 311). Refer fig.401 and 402

Refer fig.402 and 404

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18) Provided that the run on the front face of each finger is no greater than 0.005 (0,13) and the distortion at the edge of each finger is within +0.050 (1,27) to -0.030 (0,76) of original bore diameter then accept and proceed to operation 20).

Refer fig.402 and 404

19) If runout and/or distortion is outside stated limits, manually manipulate 'fingers' to within acceptable limits stated above. Refer fig.404 for maximum correctable distortion and fig.402

20) Hand dress back to required final profile. Use conventional hand tools, do not impair parent material.

Refer fig.401

21) Locally crack detect repair area.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

22) Crack detect all over.

Refer Overhaul Manual Chapter 72-52-01 Inspection/Check

23) Dimensionally inspect.

Refer fig.401

24) Mark SAL_B492928 or R10B adjacent to existing part number, using vibro-percussion engraving. Refer Overhaul Manual Chapter 72-09-00. Repair Refer fig.401 for identity location.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

DIAPHRAGM, ASSEMBLY OF, NOZZLE VANE SUPPORT.

WASPALOY BSEM735

6. DATA

7. TOOLS

NONE.

TOOL NUMBER **DESCRIPTION** QUANTITY <u>ITEM</u>

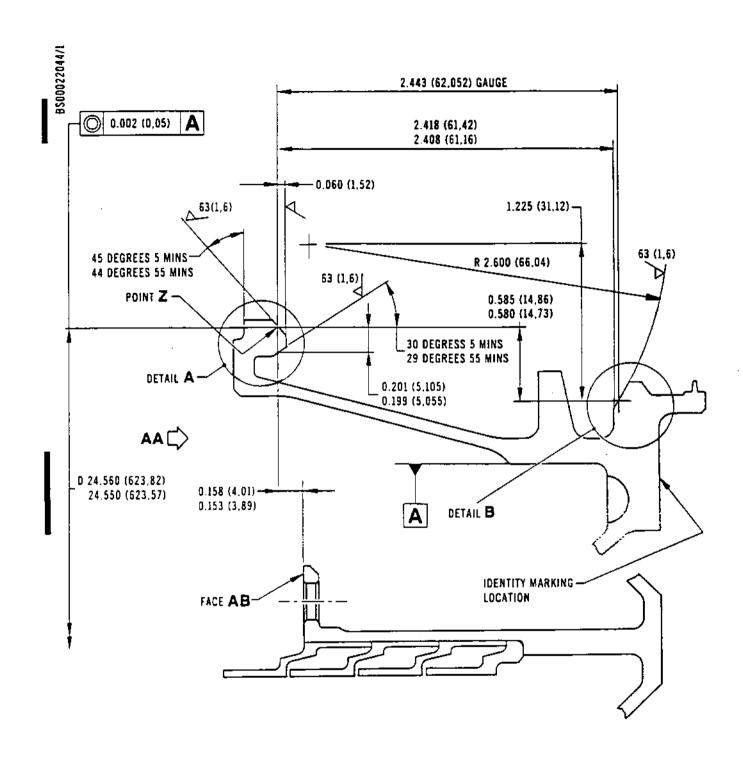
OVERHAUL

Machining Fixture S3S.92451000

1 1

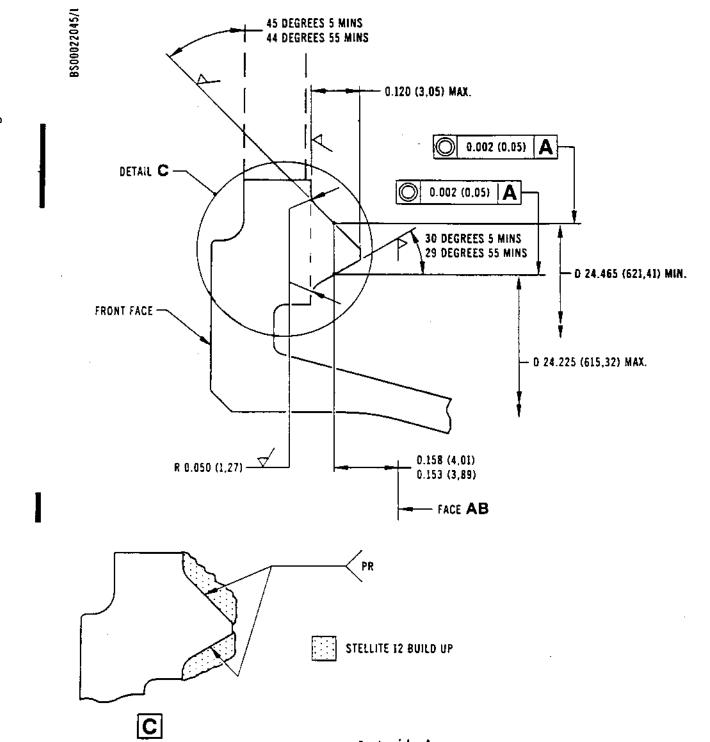
8. REPLACEMENT PARTS

NONE.



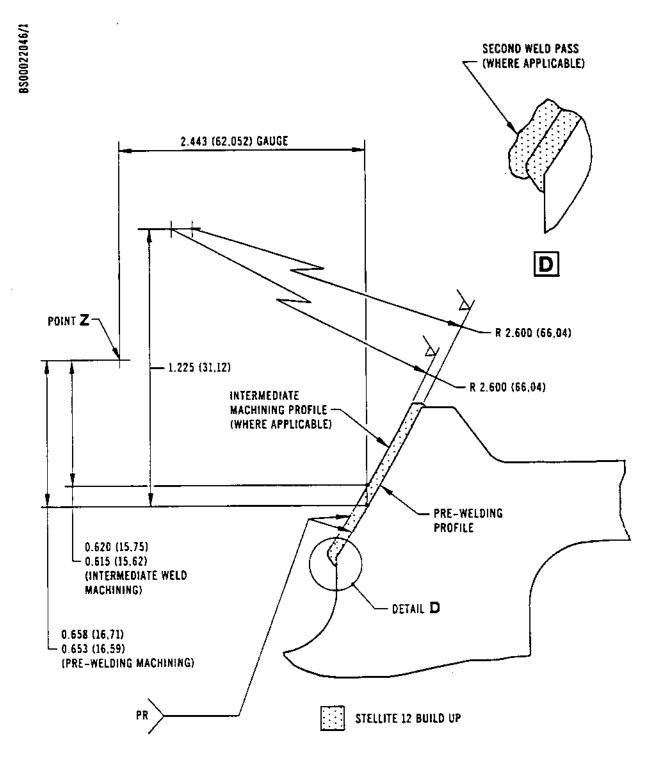
Typical Section Through Diaphragm (Finish Machining Dimensions) Figure 401

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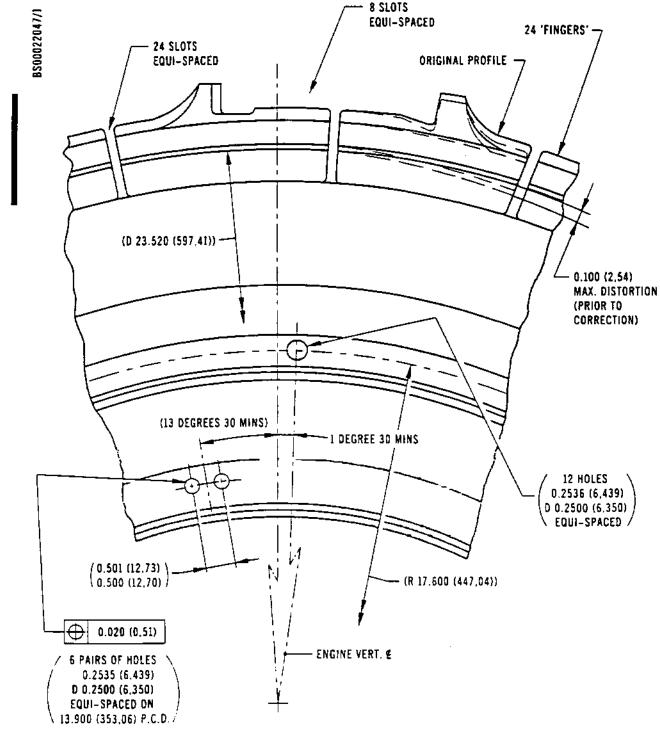
Detail A Figure 402

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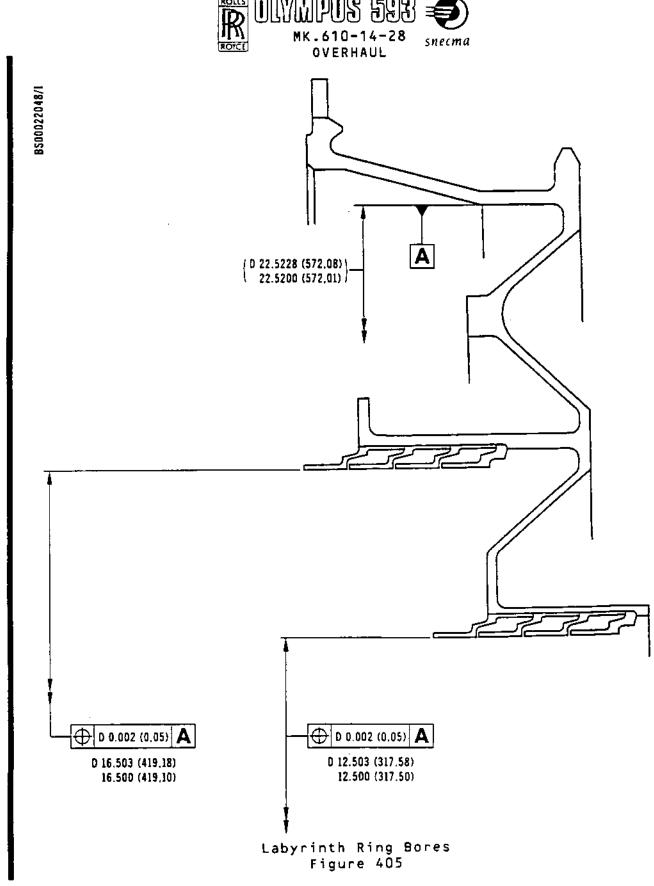
Detail B Figure 403

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Part View AA View on Diaphgram Front Face Figure 404

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VANE, ASSEMBLY OF, NOZZLE, TURBINE, LP

REPAIR OF TRAILING EDGE AND FILLET RADIUS CRACKS BY VACUUM BRAZING

REPAIR NO. B515031

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | <u>Part No.</u> |
|------------|-----------|-----------------|
| 72-52-01 | 1 80A | B927249 |
| | | B923109 |
| | 80B | B932860 |
| | • | в933351 |
| | 90A | B927233 |
| | | B923110 |
| | 90B | B932861 |
| | | B933352 |
| | 100A | B927201 |
| | , , , , , | B923111 |
| | 100B | B932862 |
| | | B933353 |
| | 110A | B927217 |
| | , , | B923112 |
| | 1108 | B932863 |
| | | B933354 |
| | 1100 | В933393 |
| | | B934120 |
| | 110E | B511091 |
| | – | B511095 |
| | | |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

A test sample is required for validation purposes prior to the initial repair and any subsequent change of process, sub-contractor or locality. Details of the validation test requirements should be obtained by writing to the Repair Authority at Rolls-Royce Plc. Prior to repair all Vane, Assembly of units are to be subject to Overhaul Manual Chapter 72-52-01 Inspection/Check requirements for wall section thickness's.

This Repair Instruction covers repair of cracks in the fillet radius area, aerofoil surfaces which are not accessible to welding and in the trailing edge. Refer Fig. 401 and 402.

This Repair Instruction may be embodied twice only, provided that limitations are not exceeded. An optional third repair may be embodied, subject to the limitations contained in Inspection/Check 72-52-01.

Cracks greater than 0.040 (1,02) in width are not repairable by this brazing procedure.

Cracks which are greater than 0.040 (1,02) in width and cracks in the leading edge zone must be welded within the limitations of Repair Scheme 8497462A (Refer Overhaul Manual, Chapter 72-52-01 Repair Number 3).

The following table gives the maximum crack lengths repairable by brazing to this Repair Instruction. Refer Figs. 402 and 403.

| CRACK LOCATION REFERENCE. | MAXIMUM | MINIMUM | MAXIMUM |
|---------------------------|------------------|------------------|------------|
| | INDIVIDUAL | DISTANCE | NUMBER OF |
| | LENGTH OF | TO NEAREST | CRACKS PER |
| | CRACK | CRACK | VANE |
| A OUTER FILLET RADIUS | 2.000 (50,80) | 0.500 (12,70) | 6 |
| B INNER FILLET RADIUS | 2.000 (50,80) | 0.500 (12,70) | 6 |
| C T/E EDGE EXCEPT | 1.500 | 0.500 | 4 |
| WITHIN AC | (38,10) | (12,70) | |
| D MID SPAN AEROFOIL | 1.500 | 0.500 | 6 |
| CONVEX AND CONCAVE | (38,10) | (12,70) | |
| E EXTENDING TOWARDS | 2.000 | 1.000 | 1 |
| L/E FROM VENT HOLE | (50,80) | (25,40) | |

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GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

Remove blanking plates and guide tube (if applicable) to the appropriate Repair Scheme.

- 2) Remove all traces of sulphidation by dry abrasive blasting at 60 p.s.i.(414 kPa) (pressure type cabinet) or by chemical stripping.
- 3) Inspect for complete removal of sulphidation.
- 4) Strip pack aluminising.
- 5) Check for complete removal of pack aluminising from internal and external surfaces using the heat tint method.

6) Dry abrasive blast at 30 p.s.i. (207 kPa) (pressure type cabinet) to remove all traces of heat tint and effects of etching.

SUPPLEMENTARY INFORMATION

Refer Overhaul Manual Chapter 72-52-01 Repair using Repairs No.2, 5 or 6.

Refer Overhaul Manual Chapter 72-09-24 Repair Use OMat 146. Refer Appendix A to this Repair Instruction.

Refer Appendix B.
NOTE: Ensure vane vent hole is free from obstruction.

Refer Overhaul Manual Chapter 72-09-05 Repair.

Dry abrasive blast, refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146. Do not handle prepared surfaces.

Heat treat for 1 hour at 5100-5900C in air, air cool. Visually inspect - a blue colour indicates base metal free from aluminising, a straw or gold colour indicates the presence of aluminising.

Refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146. NOTE: Ensure vane vent hole is free from obstruction. REPAIR

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NOTE: Part numbers B511091, B927201, B927217, B927233, B927249, B932860, B932861, B932862, B932863 and B933393 only. Service Bulletin SB.OL.593-72-8993-389 - Plugging of vent hole - may be emodied at this stage, if required, and vane assy re-part numbered accordingly. Refer to Service Bulletin for details.

If embodiment of SB.OL.593-72-8993-389 is accomplished at this stage, then disregard the following repair instructions and instead, complete the repair process in accordance with salvage scheme B517103 instructions.

- 7) Clean component using a Rolls- Vendor sample to be supplied. Royce approved Halide or Fluorocarbon cleaning process.
- Apply braze stop-off as required.
- Apply braze mix to cracks as MSRR 9500/724. required.
- 10) Carry out a Rolls-Royce approved Vendor sample to be supplied. brazing heat treatment cycle.
- 11) Remove braze stop-off.
- 12) Visually inspect repaired areas Repeat operations 7 to 11 for adequate filling of cracks. (if required).
- 13) Check internal vane surfaces using borescope to ensure adequate filling of cracks.
- 14) Carry out a Rolls-Royce approved diffusion heat treatment cycle.
- 15) Dress to restore aerofoil features as necessary. Finish flush with existing surfaces, parent material not to be impaired.
- 16) Locally etch repaired areas on vane aerofoil.
- 17) Inspect for cracks.

Vendor sample to be supplied.

NOTE: A variation of 0.003 (0,08) above the basic shape is acceptable on aerofoil surfaces.

Refer Overhaul Manual Chapter 72-09-14 Repair, using solution E.

Refer Overhaul Manual Chapter 72-51-02 Inspection/Check Refer Appendix C to this Repair Instruction.

REPAIR

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- 18) Dry abrasive blast at 30 p.s.i. (207 kPa) (pressure type cabinet) to remove all traces of heat tint and effects of etching.
- Refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146. NOTE: Ensure vane vent hole is free from obstruction.

19) Restore vane vent hole. The E.D.M. process is permissible.

- Refer Overhaul Manual Chapter 72-09-23 Repair. Refer Figs.403 and 404.
- 20) Pack aluminise all over including core, except where marked AE. Pack aluminising thickness to be 0.0015(0,038) to 0.0030(0,076). OR ALTERNATIVELY: Vapour phase deposition aluminise all over including core, except where marked AE. Vapour phase deposition aluminising thickness to be 0.0015(0,038) to 0.0030(0,076).

Refer Overhaul Manual Chapter 72-09-05 Repair. Refer Fig. 405.

21) Diffusion heat treat at 900°C + 10°C and soak for 4 hours in an inert gas atmosphere. Cool in air.

Vendors sample to be supplied.

22) Replace blanking plates and guide tube (if applicable) to the appropriate Repair Scheme. Refer Overhaul Manual Chapter 72-52-01 Repair using Repairs No.2, 5 or 6.

23) Mark Repair Instruction number RI B515031 or R11 on component adjacent to the normal 'assy. of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair Refer Fig. 401 for location of identity marking.

APPENDIX A CHEMICAL STRIPPING OF SULPHIDATION

A) Vapour degrease. Refer Overhaul Manual Chapter 72-09-00 Cleaning.

B) Chemically strip in 25% v/v nitric acid for 2 to 3 hours. Refer TSD 594 OP.122.

C) Dry abrasive blast at 30 p.s.i. (207 kPa) (pressure type cabinet).

Refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146. NOTE: Ensure vane vent hole is free from obstruction.

REPAIR

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APPENDIX B INSPECTION FOR REMOVAL OF SULPHIDATION

A) Locally swab etch surface. Maximum contact time 2 minutes. Refer Overhaul Manual Chapter 72-09-14 Repair using Solution E.

B) Visually inspect for traces of sulphidation, this will normally appear as a black deposit.

APPENDIX_C POST REPAIR ACCEPTANCE STANDARD

GENERAL

Isolated porosity up to 0.015 (0,38) is acceptable providing it does not form a chain.

AEROFOIL

Three linear indications up to 0.050 (1,27) long are acceptable providing they are at least 0.250 (6,35) apart.

FILLET RADIUS (INNER AND OUTER)

Three linear indications at each fillet radii location up to 0.050 (1,27) long are acceptable providing they are at least 0.250 (6,35) apart and do not reach a platform edge.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

VANE, ASSEMBLY OF, NOZZLE TURBINE, LP.

PD21 MSRR7138 QJD

6. DATA

NONE.

7. TOOLS

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

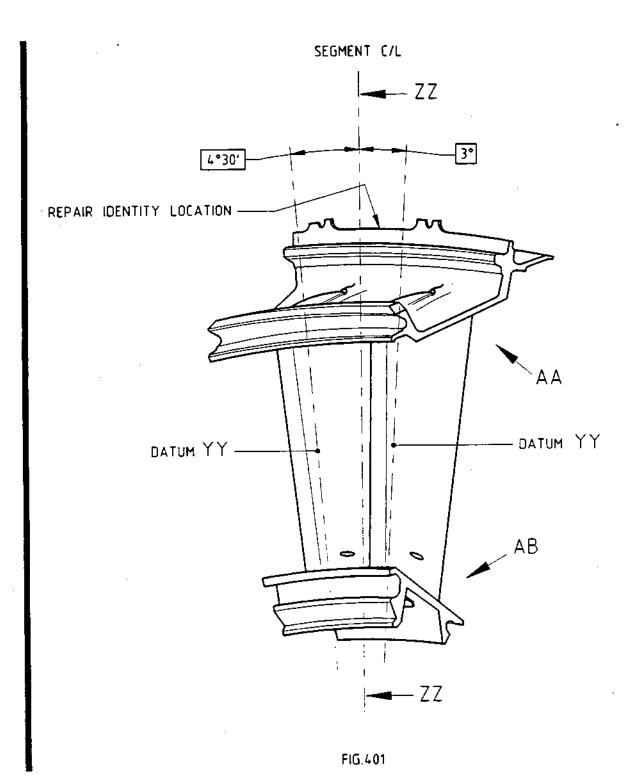
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REPAIR

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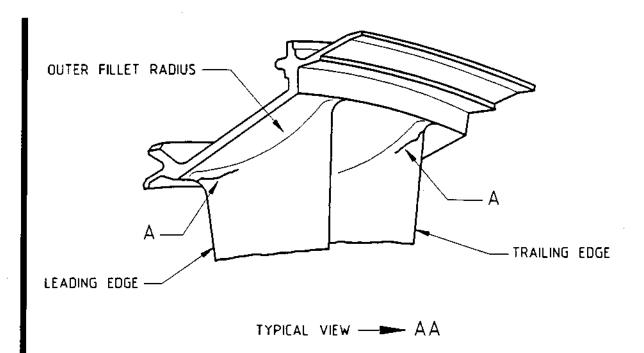
Page 406

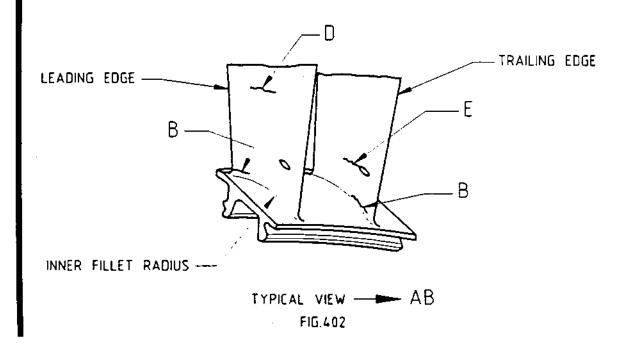
Jan 31/95



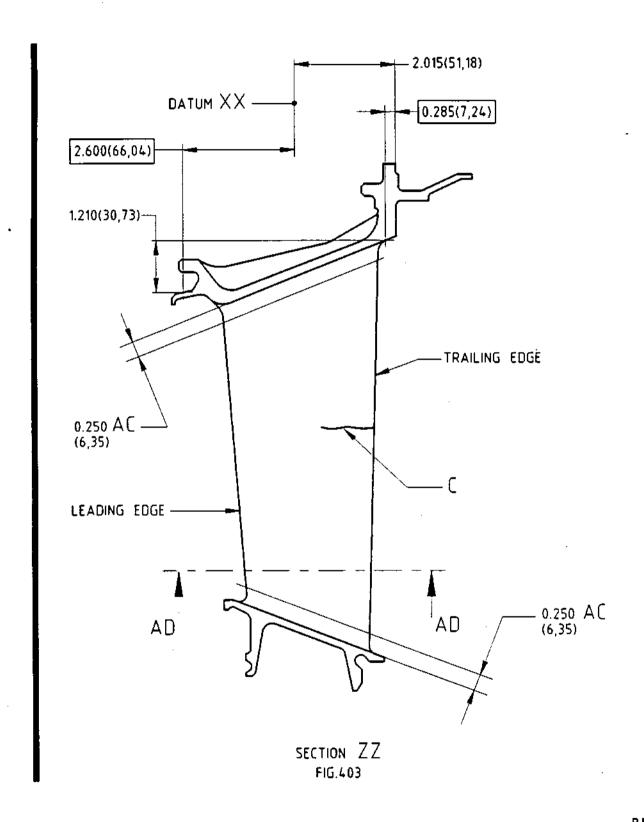
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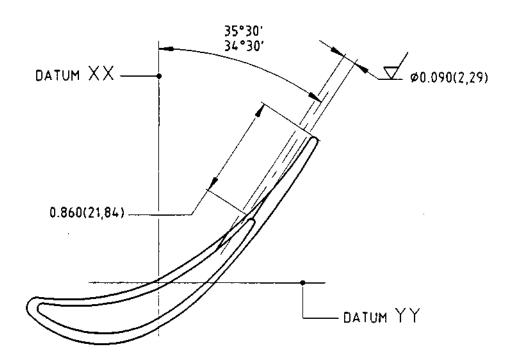


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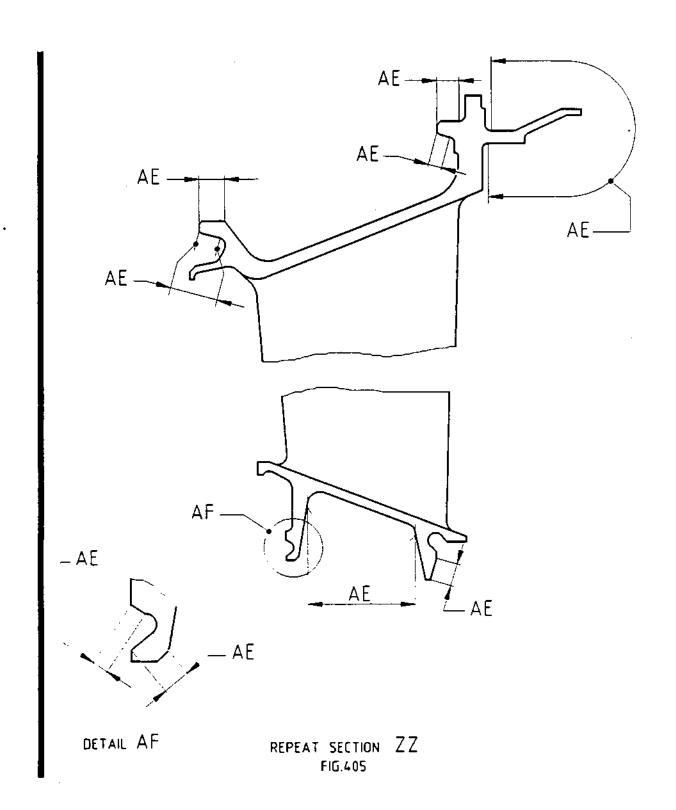
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SECTION AD FIG.404

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DIAPHRAGM, ASSY. OF, NOZZLE VANE SUPPORT

DRESSING OF LIGHT FRETTING FROM THE FRONT FLANGE ADJACENT TO THE VANE HOOK LOCATION

<u>B516721</u>

1. EFFECTIVITY

| <u>IPC</u> | <pre>Fig./Item</pre> | <u>Part No.</u> |
|-------------------|----------------------|--------------------|
| 72-52 - 01 | 1/120A | B922600 B922790 |
| | 1/120B | B922791 B927801 |
| | | B927823 B927824 |
| | 1/120c | в933278 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Outer diameter designated 'AA' (refer fig.401), with fretting up to 0.015 (0,38) max. deep, is acceptable for repair

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
3rd Angle Projection

4. REPAIR PROCEDURE

1) Using hand tools only and abrasive mat or fine grade abrasive papers/cloth, lightly polish to remove sharp edges and raised material from outer diameter AA. Do not further reduce wall section.

SUPPLEMENTARY INFORMATION

Refer fig.401.
Refer para.2. Repair
Limitations.
Refer Overhaul Manual
Chapter 72-09-22 Repair using
OMat 583 or 5/44.

72-52-01

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| 21 | Visually | incnes+ | | 2-00 |
|------------|----------|---------|--------|-------|
| <i>(</i>) | visually | inspect | repair | area. |

3) Locally etch repair area. Refer Overhaul Manual Chapter 72-09-14 Repair, using Solution C.

- Binocular inspect at X10 4) magnification.
- Locally dye penetrant inspect 5) repair area.

Refer TSD 594 OP.213

6) Locally vapour blast repair area.

Refer Overhaul Manual Chapter 72-09-13 Repair.

7) Mark Repair Instruction number RI B516721 or R13 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

> COMPONENT MATERIAL RR CODE DIAPHRAGM, ASSY. OF,

NOZZLE VANE SUPPORT.

MSRR7034 WASPALOY

QDY

6. DATA

NONE.

7. TOOLS

> TOOL NUMBER DESCRIPTION ITEM

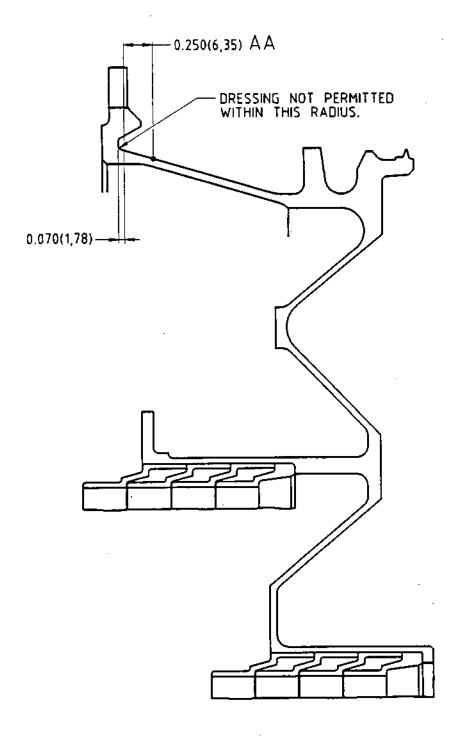
NONE.

REPLACEMENT PARTS 8.

> PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.

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TYPICAL SECTION THROUGH DIAPHRAGM FIG.401

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VANE, ASSEMBLY OF, NOZZLE, TURBINE, LP

REPAIR OF TRAILING EDGE AND FILLET RADIUS CRACKS BY VACUUM BRAZING (POST MOD. 8993 STD)

REPAIR NO. B517103

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|-----------|------------------|
| 72-52-01 | 1 80c | в933364 |
| | 80b | B515711 |
| | | в515715 |
| | | B515719 |
| | 90C | в933366 |
| | 90 D | B515712 |
| | | B515716 |
| | | B515720 |
| | 100c | B933368 |
| | 100p | B515713 |
| | | B515717 |
| | | B515721 |
| | 110c | B933370 |
| | 110p | B933392 |
| | 110E | B511083, B513812 |
| | 110F | B515714 |
| | | B515718 |
| | | в515722 |
| | | В517346 |
| | | в517347 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

A test sample is required for validation purposes prior to the initial repair and any subsequent change of process, sub-contractor or locality. Details of the validation test requirements should be obtained by writing to the Repair Authority at Rolls-Royce Plc.

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Prior to repair all Vane, Assembly of units are to be subject to Overhaul Manual Chapter 72-52-01 Inspection/Check requirements for wall section thickness's.

This Repair Instruction covers repair of cracks in the fillet radius area, aerofoil surfaces which are not accessible to welding and in the trailing edge. Refer Fig. 401 and 402.

This Repair Instruction may be embodied twice only, provided that limitations are not exceeded. An optional third repair may be embodied, subject to the limitations contained in Inspection/Check Chapter 72-52-01.

Cracks greater than 0.040 (1,02) in width are not repairable by this brazing procedure.

Cracks which are greater than 0.040 (1,02) in width and cracks in the leading edge zone must be welded within the limitations of Repair Scheme B497462A (Refer Overhaul Manual, Chapter 72-52-01 Repair Number 3).

The following table gives the maximum crack lengths repairable by brazing to this Repair Instruction. Refer Figs. 402 and 403.

| CRACK LOCATION REFERENCE. | MAXIMUM INDIVIDUAL LENGTH OF CRACK | MINIMUM DISTANCE TO NEAREST CRACK | MAXIMUM NUMBER OF CRACKS PER VANE |
|---|---|--|--|
| A OUTER FILLET RADIUS | 2.000 (50,80) | 0.500 (12,70) | 6 |
| B INNER FILLET RADIUS | 2.000 (50,80) | 0.500 (12,70) | 6 |
| C T/E EDGE EXCEPT WITHIN AC | 1.500 (38,10) | 0.500 (12,70) | 4 |
| D MID SPAN AEROFOIL CONVEX AND CONCAVE | 1.500 (38,10) | 0.500 (12,70) | 6 |

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

Remove blanking plates and guide tube (if applicable) to the appropriate Repair Scheme.

- 2) Remove all traces of sulphidation by dry abrasive blasting at 60 p.s.i.(414 kPa) (pressure type cabinet) or by chemical stripping.
- 3) Inspect for complete removal of sulphidation.
- 4) Strip pack aluminising.
- 5) Check for complete removal of pack aluminising from internal and external surfaces using the heat tint method.

6) Dry abrasive blast at 30 p.s.i. (207 kPa) (pressure type cabinet) to remove all traces of heat tint and effects of etching.

SUPPLEMENTARY INFORMATION

Refer Overhaul Manual Chapter 72-52-01 Repair using Repairs No.2, 5 or 6.

Refer Overhaul Manual Chapter 72-09-24 Repair Use OMat 146. Refer Appendix A to this Repair Instruction.

Refer Appendix B.

Refer Overhaul Manual Chapter 72-09-05 Repair.

Dry abrasive blast, refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146. Do not handle prepared surfaces. Heat treat for 1 hour at

Heat treat for 1 hour at 5100-5900C in air, air cool. Visually inspect - a blue colour indicates base metal free from aluminising, a straw or gold colour indicates the presence of aluminising.

Refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146.

REPAIR

OVERHAUL

7) Clean component using a Rolls-Royce approved Halide or Fluorocarbon cleaning process. Vendor sample to be supplied.

- 8) Apply braze stop-off as required.
- 9) Apply braze mix to cracks as required.

MSRR 9500/724.

10) Carry out a Rolls-Royce approved brazing heat treatment cycle. Vendor sample to be supplied.

- 11) Remove braze stop-off.
- 12) Visually inspect repaired areas for adequate filling of cracks.

Repeat operations 7 to 11 (if required).

- 13) Check internal vane surfaces using borescope to ensure adequate filling of cracks.
- 14) Carry out a Rolls-Royce approved diffusion heat treatment cycle.

Vendor sample to be supplied.

15) Dress to restore aerofoil features as necessary. Finish flush with existing surfaces, parent material not to be impaired.

NOTE: A variation of 0.003 (0,08) above the basic shape is acceptable on aerofoil surfaces.

16) Locally etch repaired areas on vane aerofoil. Refer Overhaul Manual Chapter 72-09-14 Repair, using solution E.

17) Inspect for cracks.

Refer Overhaul Manual Chapter 72-51-02 Inspection/Check Refer Appendix C to this Repair Instruction.

18) Dry abrasive blast at 30 p.s.i. (207 kPa) (pressure type cabinet) to remove all traces of heat tint and effects of etching. Refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146.

> 72-52-01 Repair No. 14

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19) Pack aluminise all over including core, except where marked AE. Pack aluminising thickness to be 0.0015(0,038) to 0.0030(0,076).

OR ALTERNATIVELY:
Vapour phase deposition aluminise all over including core, except where marked AE. Vapour phase deposition aluminising thickness to be 0.0015(0,038) to 0.0030(0,076).

Refer Overhaul Manual Chapter 72-09-05 Repair. Refer Fig.404.

Vendors sample to be supplied.

- 20) Diffusion heat treat at 900°C \pm 10°C and soak for 4 hours in an inert gas atmosphere. Cool in air.
- 21) Replace blanking plates and guide tube (if applicable) to the appropriate Repair Scheme.

Refer Overhaul Manual Chapter 72-52-01 Repair using Repairs No.2, 5 or 6.

22) Produce additional vent hole 0.090 (2,29) dia in each outer blanking plate.

Refer to Fig.405. Hole may be produced prior to brazing.

- 23) Remove any burrs.
- 24) Locally crack detect area around 0.090 (2,29) dia holes.

Refer to TSD 594 OP.213.

25) Mark Repair Instruction number RI B517103 or R14 on component adjacent to the normal 'assy. of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair Refer Fig. 401 for location of identity marking.

APPENDIX A CHEMICAL STRIPPING OF SULPHIDATION

A) Vapour degrease.

Refer Overhaul Manual Chapter 72-09-00 Cleaning.

B) Chemically strip in 25% v/v nitric acid for 2 to 3 hours.

Refer TSD 594 OP.122.

C) Dry abrasive blast at 30 p.s.i. (207 kPa) (pressure type cabinet).

Refer Overhaul Manual Chapter 72-09-24 Repair. Use OMat 146.

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APPENDIX B INSPECTION FOR REMOVAL OF SULPHIDATION

A) Locally swab etch surface. Maximum contact time 2 minutes. Refer Overhaul Manual Chapter 72-09-14 Repair using Solution E.

B) Visually inspect for traces of sulphidation, this will normally appear as a black deposit.

APPENDIX C POST REPAIR ACCEPTANCE STANDARD

GENERAL

Isolated porosity up to 0.015 (0.38) is acceptable providing it does not form a chain.

AEROFOIL

Three linear indications up to 0.050 (1,27) long are acceptable providing they are at least 0.250 (6,35) apart.

FILLET RADIUS (INNER AND OUTER)

Three linear indications at each fillet radii location up to 0.050 (1,27) long are acceptable providing they are at least 0.250 (6,35) apart and do not reach a platform edge.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

VANE, ASSEMBLY OF, NOZZLE TURBINE, LP.

PD21

MSRR7138

QJD

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

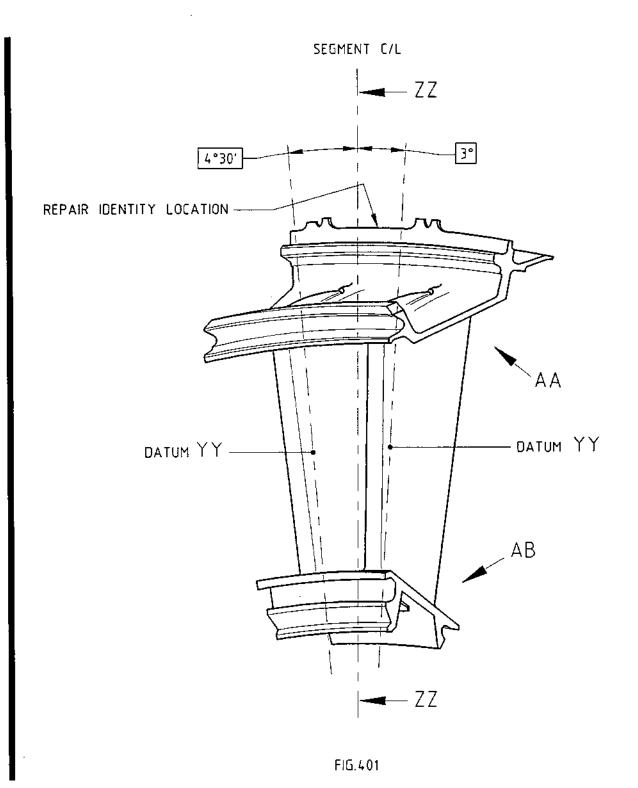
QUANTITY

ITEM

NONE.

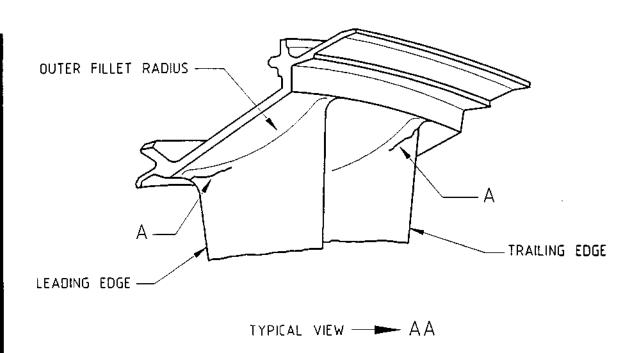
72-52-01 Repair No. 14

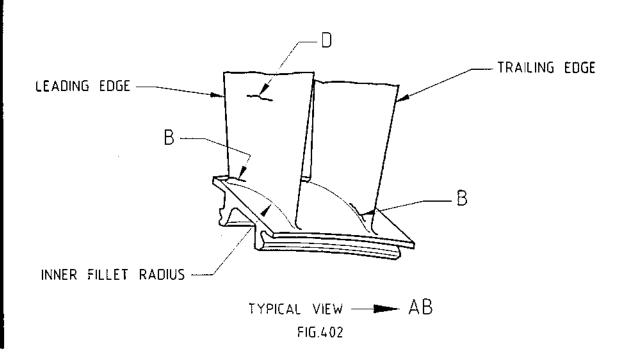
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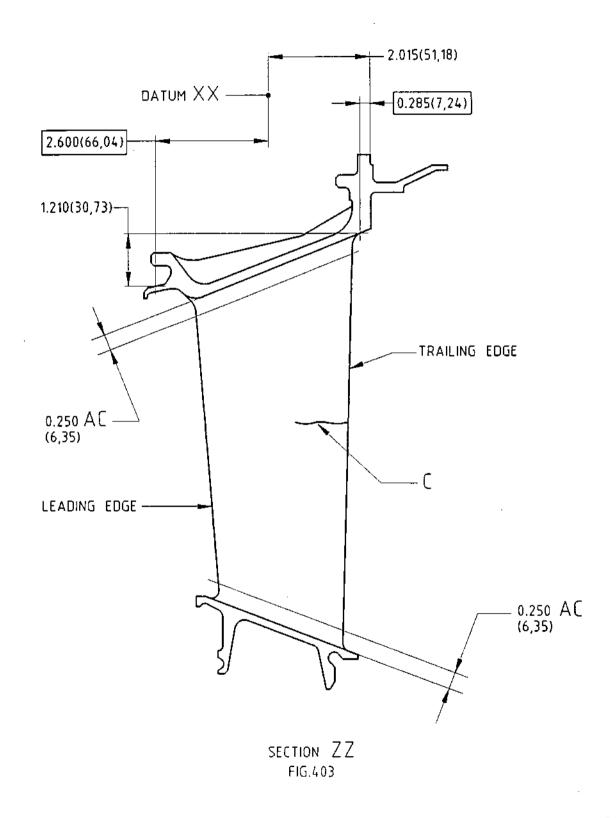
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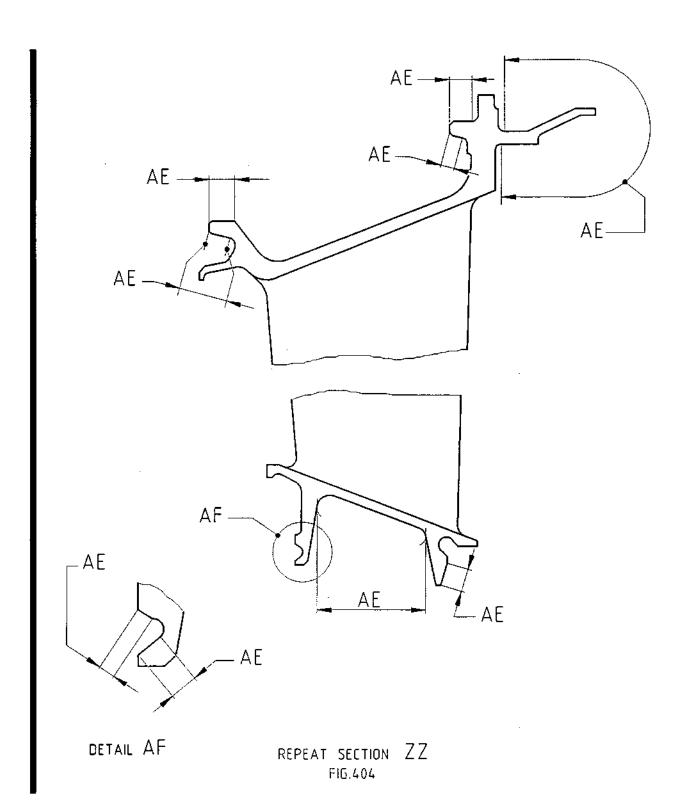




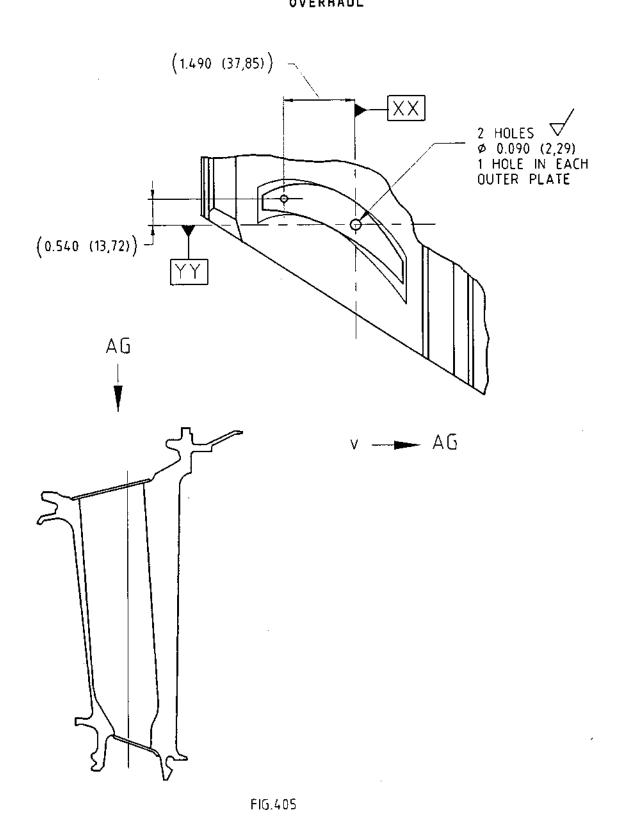
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CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-507
Insert in 72-52-01 at rear of repair section in RST No. order

REASON FOR ISSUE:

L.P. turbine N.G.V. support diaphragm - restoration of fretted stator support faces front and rear (MRA 54).

ACTION

Add new BEOL REPAIR to read as follows:

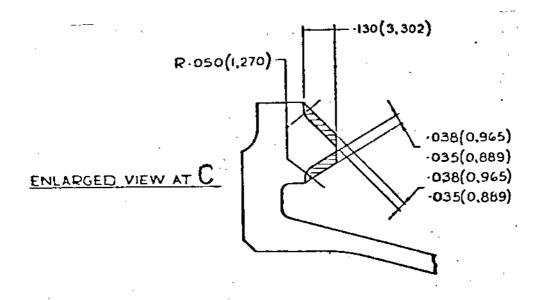
BEOL REPAIR: RST 4003 Weld repair to restore front and rear stator support faces.

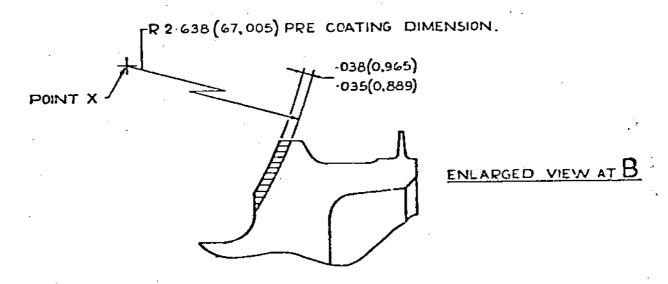
PROCEDURE:

1. PREPARATION

- (a) View at 'C' Front Angled Face. Clean existing Stellite 12 deposit prior to application of new weld.
- (b) View at 'B' Rear Concave Face. Machine to pre-coating dimensions.
- Crack test by fluorescent dye penetrant per Overhaul Manual FlA Process.
- 3. Apply Stellite 12 coating at 'B' and/or 'C' as appropriate.
 Use filler rod to MS RR 9500/15, Colour Code Pink/Black/Green.
 Apply by manual argon arc method.
- 4. Crack test as in Opn. 2.
- 5. Final machine to finished dimensions.
- 6. Crack test as in Opn. 2.
- 7. Wet abrasive blast to obtain an even matt finish using 320/400 aluminium oxide grit in water suspension i.e. 2KG grit to 10 litres of water. Pressure at 80 p.s.i.
- 8. Vibro engrave 'RST 4003' together with '/F' and/or '/R' (i.e. front or rear as applicable) adjacent to part number.
- NB This R.S.T. is written in accordance with RR OLY/SEDP/415.

TEMPORARY REVISION No. 72-507

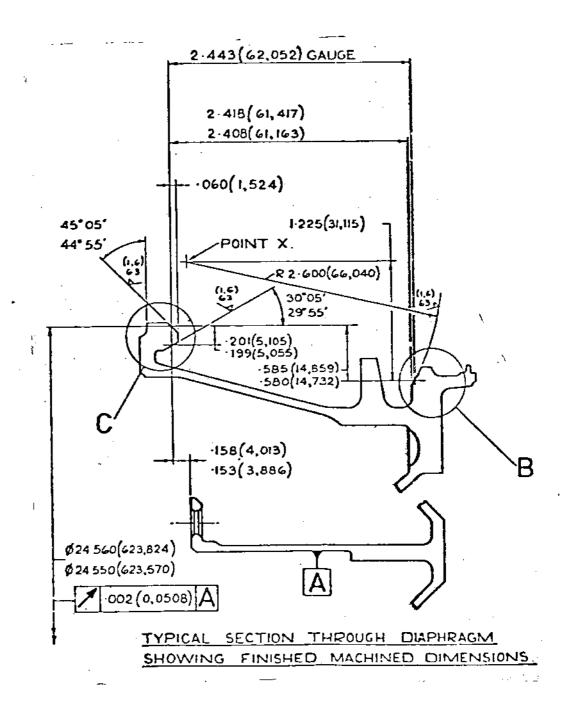




STELLITE 12 TO BE APPLIED TO SUPFACES MARKED
THUS NOTE. WHERE STELLITE 12 DEPOSIT ALREADY EXISTS,
VIEW AT C. EXISTING DEPOSIT NEED NOT BE REMOVED.
AREAS OF FRETTING MAY BE BUILT UP BY APPLYING
FURTHER DEPOSITS OF STELLITE 12.

ب. ب. ا

TEMPORARY REVISION No. 72-507



CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-508

Insert in 72-52-01 rear of repair section in RST No. order

REASON FOR ISSUE:

Damage to pack aluminised coating on L.P. turbine NGV's (MRA 62).
ACTION

BEOL REPAIR: RST 4006. L.P. turbine NGV's repair to damaged pack aluminised coating by application of Sermaloy 'J'.

PROCEDURE

- 1. Apply Sermaloy 'J' in accordance with the process quoted in the Rolls-Royce Overhaul Process Manual TSD.594 Op.339 Part 4.
 - N.B. (a) No deviation from the quoted process is permitted.
 - (b) Any amount of the pack aluminised coating may be repaired.
 - (c) Observe the CAUTION NOTE on Page 22 (TSD.594-339) warning of the highly toxic nature of Sermaloy 'J'.
 - (d) Application of Sermaloy 'J' by spray gun is preferred for coating thickness control and coating integrity and is the recommended method. Minor areas of coating damage may, however, be repaired using a suitable brush (Refer Opn.7 Page 23 of TSD.594-339). Observe the caution regarding the skill of the operator.
- 2. Diffusion heat treat for two hours at $870^{\rm OC}$ to $890^{\rm OC}$ in argon with a volume change of 6 times per hour

15.00

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-523

Insert in 72-52-01 at rear of repair section in RST No. order

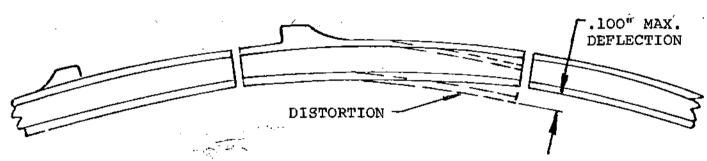
REASON FOR ISSUE:

Removal of distortion from L.P. turbine N.G.V. support diaphragm, at diaphragm slotted segment fingers. (MRA 81).

ACTION

BEOL REPAIR: RST 4008. Remove distortion from slotted segment 'fingers' which can occur during weld repair RST 4003.

PROCEDURE



- 1. Manually tweak to correct position.
 - N.B. After true up the part is acceptable provided that:
 - (a) There is no more than .005 in. run on front face of each finger.
 - (b) There is no more than a .005 in. step between adjacent fingers.
- 2. Crack detect to O.H.M. fia. process.
- 3. Vibro-engrave RST 4008 adjacent to P/No.

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-524

Insert in 72-52-01 at rear of repair section in RST No. order

REASON FOR ISSUE:

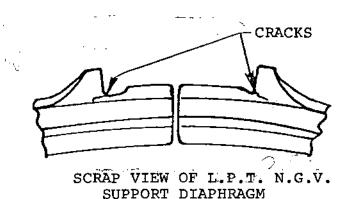
L.P. turbine N.G.V. support diaphragm - cracking in location dog corners. (MRA 84).

ACTION

BEOL REPAIR: RST 4010. Support diaphragm - repairing cracks - dressing and welding.

PROCEDURE

- 1. Rout out crack keeping dressing to a minimum.
- 2. Prepare location for welding as per Overhaul Manual.
- 3. Load blends with weld filler using manual argon arc. Use filler rod MS RR 9500/15 Stellite 12 colour code Pink/Black/Green. Weld per TSD.594-409.
- 4. Crack detect using fluorescent dye penetrant to RPS 702 refer to Overhaul Manual Process FlA.
- 5. Restore slot features working to original contours and surfaces.
- 6. Dimensionally check.
- 7. Crack detect using fluorescent dye penetrant to RPS 720 refer to Overhaul Manual Process F1A.
- 8. Vibro-engrave RST 4010 adjacent to P/No.
- 9. Final inspect.



CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-544

Insert in 72-52-01 at rear of repair section in RST No. order

REASON FOR ISSUE:

L.P. Turbine NGV - cracking at blank plate braze.

ACTION

B.E.O.L. REPAIR

RST 4028 L.P. TURBINE NOZZLE GUIDE VANES: RE-BRAZE OUTER BLANK PLATE BRAZE CRACKS

- a) The following repair procedure applies to Non T.C.A. Probe Vanes Only, that feature cracking in the outer shroud blank plate securing braze. The crack must be 'tight' with no evidence of the plate lifting. Plate lift indicates that it must be replaced.
- b) One crack up to 1.00" in length, or more than one crack where the total lengths do not exceed 1.00", are acceptable as is without repair. These cracks must show no evidence of the plate lifting.
- Grind the blank plate locally to form a slight step (.030" Max), in the two areas where the blank plate overlaps the shroud.
- 2) Using a small cutter dress away the braze fillet all around the plate.
- 3) Thoroughly clean around the plate and adjacent shroud areas by blasting using silicon carbide grit.
- 4) Dry air blast to remove all traces of silicon carbide grit.
- 5) Vacuum furnace re-braze all around the plate using nicrobraz 130 powder (or endurance CM.52). Braze temperature 1050°C 1100°C.. Vacuum 1-5 x 10-4 Torr. A neat fillet is required. Refer T.S.D. 594 416.
- 6) Inspect the braze and vane per T.S.D. 594 416.
- 7). Vibro engrave 'RST 4028' adjacent to part number.
- 8) Finally Inspect.

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1 May 1981



DIAPHRAGM, ASSEMBLY OF, NOZZLE VANE SUPPORT

REPAIR OF CRACK(S) AT VANE LOCATING DOG (SLOT) POSITIONS BY WELDING

REPAIR NO. <u>B517822</u>

EFFECTIVITY 1.

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|-------------------------------|
| 72-52-01 | 1 120A | B916177 B922579 B922600 |
| | 1 120B | 8927801, 8927823, 8927824 |
| | 1 120c | в933278 |

REPAIR LIMITATIONS 2.

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED Drawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimetres) Tolerances on machined dimensions plus/minus 0.010 (0,25) Tolerance on angles plus/minus 2 degrees Break sharp edges 0.004 to 0.020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 125 (3,2) Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

ALL TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

Repair No. 15

REPAIR

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4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

A. Penetrant Crack Test

1) Do a penetrant crack test on the part to determine exact location(s) of crack(s). Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-001. Use OMat 653 Fluorescent penetrant Medium sensitivity. Use penetrant crack test equipment.

- B. <u>Vee-Groove Out Crack(s)</u>
- Vee-groove out cracked area(s) to remove all crack indications.

TASK 70-00-00-300-409 SUBTASK 70-00-00-860-409-052. Refer to Fig.402.

NOTE: Remove sufficient stellite from the cracked area(s) to ensure contamination does not occur during welding.

- Thoroughly clean and prepare area(s) for welding.
- C. Weld the Part
- 1) Apply the weld filler to the repair area(s).

Refer to TASK 70-00-00-300-409. Use OMat 3/99 Welding wire, nickel base. Use argon arc welding equipment Weld group 2. Refer to Fig.402.

NOTE: Take precautions to prevent distortion.

- D. Dress Welded Area(s)
- 1) Dress welded area(s) flush with adjacent surfaces maintaining drawing dimensions. Surface finish to be as adjacent area(s).

Use hand held tools Refer Overhaul Manual 72-09-22. Refer to Fig.401 and 402.

NOTE: Do not impair parent material.

E. Penetrant Crack Test

 Do a penetrant crack test on the part.

Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-001. Use OMat 653 Fluorescent penetrant Medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

- F. Examine the Part
- Do a dimensional inspection of the part.

Refer to Fig. 401 and 402.

- G. <u>Identify the Repair</u>
 - Mark on B517822 or R15 adjacent to the part number.

Refer to TASK 70-00-00-300-363 SUBTASK 70-00-00-180-363-027. Use vibration peen equipment.

5. DATA

NONE.

NONE.

6. <u>TOOLS</u>

TOOL NUMBER

TOOL DESCRIPTION

QTY

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7. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

NONE.

8. STANDARD EQUIPMENT

Argon arc welding equipment.
Hand held tools.
Heat treatment equipment.
Penetrant crack test equipment.

9. CONSUMABLE MATERIAL

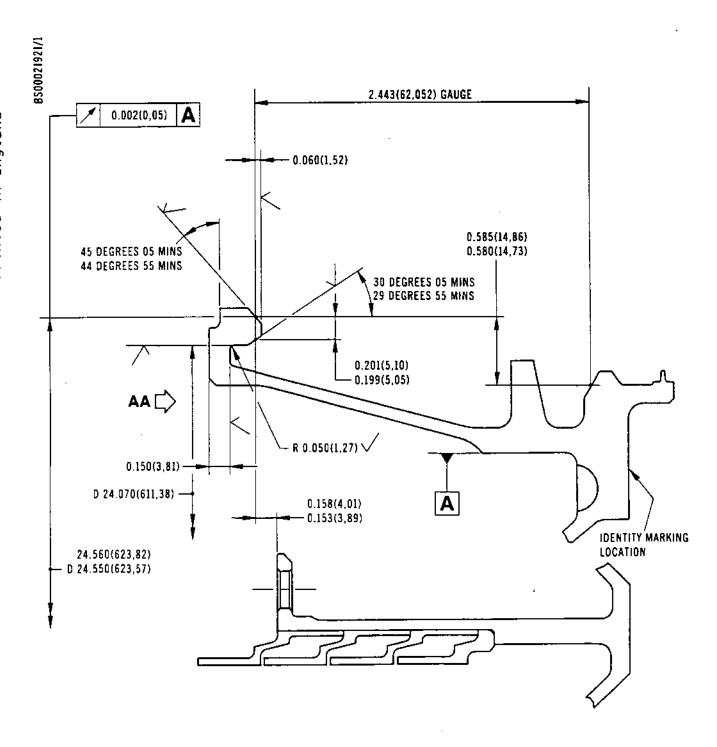
OMat 3/99 OMat 653 Welding wire, nickel base. Fluorescent penetrant Medium sensitivity.

NOTE: 1. To identify the consumable materials refer to the Overhaul Materials Manual (OMat).

 Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

10. EXPENDABLE_PARTS

NONE.



Typical Section Through Diaphragm Figure 401

REPAIR 72-52-01 Repair No. 15 Page 405 Dec 30/98

TYPICAL CRACKS BS00021922/1 24 SLOTS (8 SLOTS EQUI-SPACED) EQUI-SPACED 24 "FINGERS" 12 HOLES 0.2535(6,439) Ø0.2500(6,350) EQUI-SPACED (13 DEGREES) 30 MINS) (1 DEGREE 30 MINS) (0.501(12,73)) (0.500(12,70)) (R 17.600(447.04)) 0.020(0,51) 6 PAIRS OF HOLES 0.2535(6,439) ENGINE VERT. € Ø0.2500(6,350) EQUI-SPACED ON 13.900 (353,06) P.C.D.

PART VIEW AA
View on Diaphragm Front Face
Figure 402

REPAIR 72-52-01 Repair No. 15 Page 406 Dec 30/98



DIAPHRAGM, ASSEMBLY OF, NOZZLE VANE SUPPORT - RESTORATION OF WORN SEAL FIN BY MECHANISED T.I.G. WELDING B518042

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|------------------------------|
| 72-52-01 | 1-120A | B922600, B922790, B922791 |
| | 1-120B | B927801, B927823, B927824 |
| | 1-120c | B933278 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process shall be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This instruction gives the procedure for the restoration of worn Seal Fin by Mechanised T.I.G. welding on the Diaphragm, Assembly of, Nozzle Vane Support.

A test sample is required for validation purposes prior to the initial repair and any subsequent change of process, sub-contractor or locality. Details of the validation test requirements should be obtained by writing to the Repair Authority at Rolls-Royce plc.

A maximum of five applications of this Repair Instruction is permissible.

Where turning is used and cut is less than 0.005 (0,127), particular attention must be paid on inspection, to cracking along grain boundaries or along twins in the grains themselves.

3. GENERAL

UNLESS OTHERWISE SPECIFIED brawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimetres) Tolerances on machined dimensions plus/minus 0.010 (0,25) Tolerance on angles plus/minus 2 degrees Break sharp edges 0.004 (0,1) to 0.020 (0,5)

REPAIR

72-52-01 Repair No.17 Page 401 Jun 30/00 Machine where marked
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J).

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. Remove Labyrinth Rings
- 1) Remove the No. 24 and 25 Labyrinth Rings.

Refer to Overhaul Manual Chapter 72-52-01. Repair using Repair No. 7 for removal method.

- B. Machine the Part.
- Install the part in the machining fixture.

Use \$3\$92451000 Machining fixture 1 off. Refer to Fig. 401 and 402.

Machine the part to the applicable dimension.

Use machining equipment. Refer to Fig. 401 and 402.

- C. Examine the Part
- 1) Do a dimensional inspection of the machined location. NOTE: Record dimension AX and diameter AY for use at final machining operation

Use inspection equipment. Refer to Fig. 401 and 402.

- D. Penetrant Crack Test.
- Do a penetrant crack test on the repair area.

Refer to TASK 70-00-00-200-213. SUBTASK 70-00-00-230-213-002. Use OMat 653 Fluorescent penetrant, medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

REPAIR

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REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

E. Weld the Part.

1) Apply the weld filler to the repair area. NOTE: Ensure sufficient weld is applied to enable achievement of finish machined sizes.

Refer to TASK 70-00-00-300-409. Use OMat 3/99A Welding wire, nickel base. Use argon arc welding equipment weld group 2. Refer to Fig. 402 and 403.

F. Examine the Part.

 Do a dimensional inspection of the part to ensure final machine dimensions can be achieved. Use inspection equipment. Refer to Fig. 402 and 403.

G. Penetrant Crack Test.

 Do a penetrant crack test on the repair area. Refer to TASK 70-00-00-200-213. SUBTASK 70-00-00-230-213-002. Use OMat Fluorescent Penetrant, medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

H. Machine the Part.

 Install the part in the turning fixture. Use \$3\$9245100 Machining fixture 1 off. Refer to Fig. 401 and 403.

2) Machine the part to the applicable dimensions.
NOTE: Use dimensions AX and AY recorded in Para.4.C.1)

Use machining equipment. Refer to Fig. 401 and 403.

J. Heat treat the Part.

1) Heat treat the part.

Refer to TASK 70-00-00-300-409. SUBTASK 70-00-00-370-409-014. Heat in vacuum or Argon to Between 750 to 770 deg.C. (1382 to 1418 deg.F.) for 16 hours. Use vacuum/argon atmosphere furnace.

REPAIR

72-52-01Repair No.17

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REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

2) Cool the part.

Gas fan quench to 150 deg.C. (302 deg.F.). Air cool to room temperature.

- K. Examine the Part.
- Examine and measure the Dimensions of the repair Area.

Use inspection equipment. Reject if outside limits. Refer to Fig. 401 and 403.

- L. Etch the Repaired Area.
- Do a swab etch of the repaired area.

Refer to TASK 70-00-00-200-214. SUBTASK 70-00-00-110-214-A01.

- M. Penetrant Crack Test.
- Do a penetrant crack test on the repair area.

Refer to TASK 70-00-00-200-213. SUBTASK 70-00-00-230-213-002. Use OMat 653 Fluorescent penetrant, medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

- N. Clean the Part.
- Vapour blast the repair area.

Refer to TASK 70-00-00-300-338. SUBTASK 70-00-00-120-338-001. Use OMat 1/244 Abrasive medium at Almen 2N intensity with 200% coverage. Use abrasive blasting equipment.

- P. Replace Labyrinth Rings.
- Replace the No. 24 and 25 Labyrinth Rings.

Refer to Overhaul Manual Chapter 72-52-01. Repair using Repair No.7 for replacement method. Do not mark the salvage number for Repair No. 7.

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REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

R. Identify the Repair.

 Vibration peen B518042 or R17, and repeat repair suffix if applicable. adjacent to the part number. Refer to TASK 70-00-00-300-363. SUBTASK 70-00-00-180-363-027. Use vibration peen equipment. For repeat repairs to this instruction (on the same part), add a suffix /2, /3 etc. as applicable (to indicate second occassion, third occasion etc.).

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

DIAPHRAGM ASSEMBLY.
OF, NOZZLE VANE
SUPPORT.

MSRR 7034 Waspaloy QDY

6. DATA

NONE

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

S3S92451000

Machining fixture

1

8. REPLACEMENT PARTS

PART_NUMBER

DESCRIPTION

QUANTITY

ITEM

NONE

9. STANDARD EQUIPMENT

Abrasive blasting equipment
Argon arc welding equipment
Inspection equipment
Machining equipment
Penetrant crack test equipment
Vacuum/Argon atmosphere furnace
Vibration peen equipment

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10. CONSUMABLE MATERIAL

OMat 1/224 Abrasive medium

OMat 3/99A Welding wire, nickel base

OMat 653 Fluorescent penetrant, medium sensitivity

NOTE: 1. To identify the consumable materials refer to the Overhaul Materials Manual (OMat).

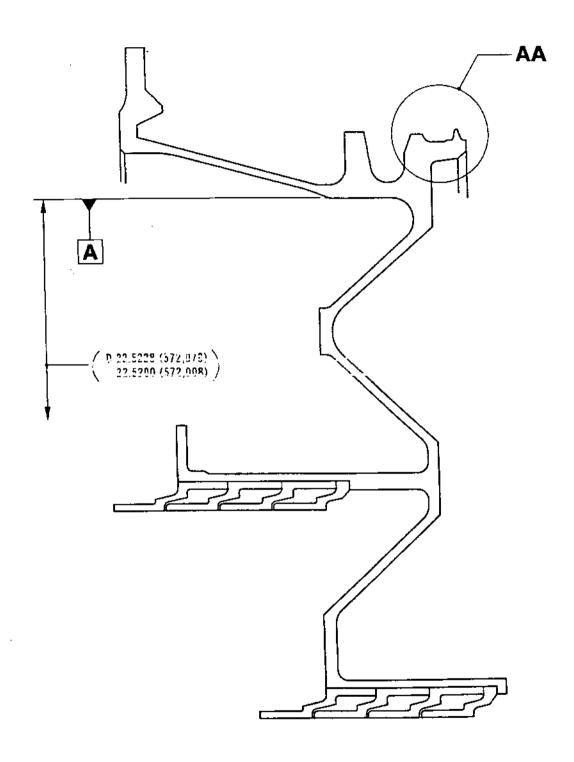
 Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

11. EXPENDABLE PARTS

NONE.

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BS00025334/1

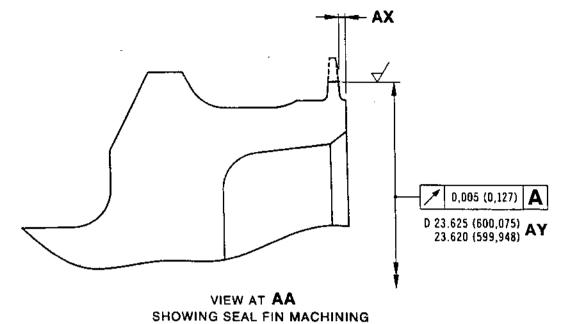


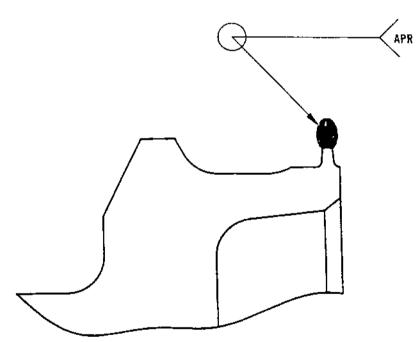
Section through diaphragm Fig. 401

REPAIR

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PRIOR TO WELD BUILD UP

. . .

VIEW AT AA SHOWING SEAL FIN WELD BUILD UP

View at AA Showing seal fin weld build up Fig. 402

REPAIR

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0,002 (0,05) MAX 15 DEGREES STEP (BOTH SIDES) 0.010 (0,254) 0.005 (0,127) AX VIEW AT AB $\begin{pmatrix} R \ 0.030 \ (0.762) \\ 0.020 \ (0.508) \end{pmatrix}$ AB 0.00.005 (0,127) DIA AY D 23.760 (603,504) GAUGE 23.750 (603,250)

VIEW AT **AA** SHOWING SEAL FIN MACHINING AFTER WELD BUILD UP

View at AA Showing seal fin machining after weld build up Fig.403

REPAIR

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LP TURBINE ROTOR - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|-----------|------------|---|-----------------|
| pue. | 1 | Rotor Hub Labyrinth Fins Repaired by Roll Forming | SAL.B.478177-80 |
| n England | 2 | Labyrinth Ring Fins Repaired by Roll Forming | SAL.B.478112 |
| ted in | 3 | Labyrinth Housing Seal Lands Repaired by Application of Abradable Coating | SAL.B.478114-5 |
| Printed | 4 | LP Turbine Disks Repaired by Blending to Remove Light Impact and Other Damage | SAL.B.497541 |
| | 5 | LP Turbine Disks Repaired by Blending Damage/Defects in Bolt-Holes | SAL.B.499437 |
| | 6 | LP Turbine Disks Repaired by Blending Light Scores in Bores and Faces | SAL.B.499439 |
| | 7 | LP Turbine Disks Repaired by Blending Fret Marks on Front Face | SAL.B.499469 |
| | 8 | Repair of No.25 Labyrinth Fins by Plasma Welding | SAL.B.488619 |
| | 9 | Rotor Hub Labyrinth Fins Restored by TIG Welding | SAL.B.488628-31 |
| | 10 | LP Turbine Blade Repaired by Blending Damage on Root and Seal Fin | SAL.B.512676 |
| _ | 11 | Blade, Turbine LP Assembly of. Remove and replace defective bridgepiece | SAL.B.517886 |



LP TURBINE ROTOR - REPAIR ROTOR HUB LABYRINTH FINS REPAIRED BY ROLL FORMING

MODIFICATION NO. OL.8328C

Effectivity

I.P.C.

Fig./Item

Part No.

72-52-02

1 210A

B.922662

1. Introduction

- A. This Repair describes the procedure for restoring defective fins on the rotor hub in order to maintain the standard fin/housing clearances of labyrinth No.27, No.28, No.29 and No.30. The diameter of each fin is first increased by roll forming then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the roll forming technique applicable to this repair procedure.
- C. Dimensions are shown thus in Table 401 and on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. This Repair may be applied once only.
- B. Fins which have previously been repaired by welding must not be restored by roll forming.
- C. Verify that there is adequate material at each defective location to permit machining to the dimensions before roll forming (Ref.para.3.B.).

Summary of Operations

- A. Locate the large end of the rotor hub on the centre-lathe faceplate. Secure the hub and set true on datum diameter A (Ref.Fig.401).
- B. Clean up defective fins; remove only the minimum amount of material to achieve the specified dimensions (Ref.Fig.402). A localised "witness", not exceeding 0.003 in. (0,076 mm) in depth, is acceptable.

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- C. Carefully remove any burrs.
- D. Apply the roll forming technique to increase the diameter of defective fins to the roll forming dimensions (Ref. Fig. 403 and 404).
- E. Remove any folds by careful blending (Ref.Fig. 403).
- F. Crack test the rotor hub with fluorescent-penetrant.
- G. Finish machine the fins to the specified dimensions (Ref.Fig.401); a maximum of 1.000 in. (25,4 mm) of the circumference which has not cleaned up is acceptable on each fin.
- H. Polish fins to remove sharp edges.
- J. Chemically etch the rotor hub using solution C and etching technique, (Ref. 72-09-14 Repair) and repeat the test for cracks (Ref.para.F).
- K. Vapour blast the hub; use grit mesh 320/400.
- L. Identify repair (Ref. Table 401). Mark the appropriate repair scheme number close to the standard part number on the rotor hub.

| REPAIR SCHEME NO. | VIEW AT | RADIUS FIGURE | MAXIMUM RADII 403 AND 404) |
|----------------------|----------|------------------|-------------------------------|
| SAL.B.478177 | AB AC | J | 5.588 (141,935) |
| SAL.B.478178 | AD AE | K | 4.226 (107,340) |
| SAL.B.478179 | AF AG | L | 3.545 (90,043) |
| SAL.B.478180 | Ан | М | 2.753 (69,926) |

Roll Forming Dimensions Table 401

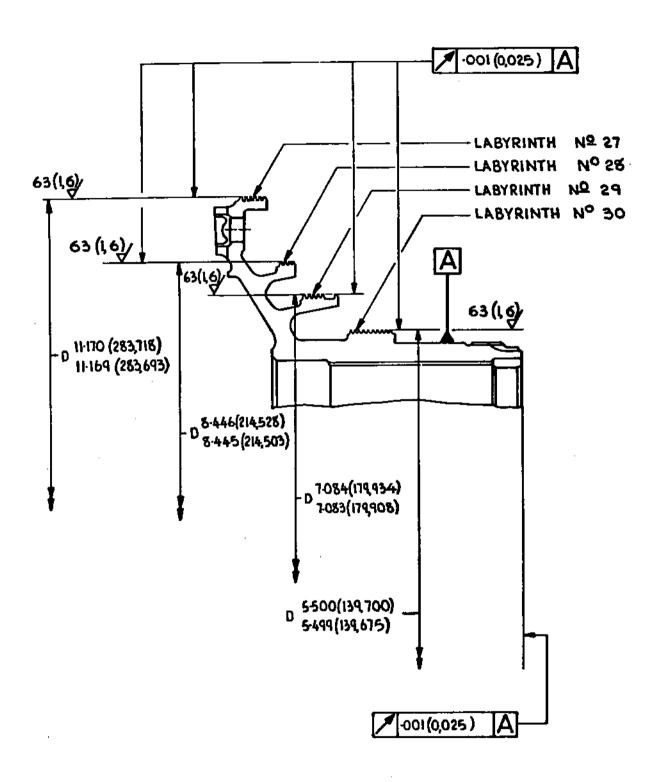
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4. Special Tools, Fixtures and Equipment

| Description | Quantity | Tool No. | Item |
|--|----------|-------------------|------|
| Tool Holder Rolling Tool Roller Roller Shims | 1 | \$3\$.12358000 | 1 |
| | 1 | \$3\$.12363000 | 2 |
| | 1 | \$3\$.12374000 | 3 |
| | 2 | \$3\$.12382000 | 4 |
| | 4 | \$3\$.12375-78000 | 5 |

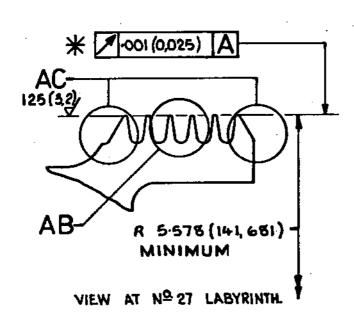
- A. SAL.B.478177-9. Use items 1, 2, 3, 4 and 5.
- B. SAL.B.478180. Use items 1, 2, 4 and 5.
- 5. Replacement Parts
 - A. Not required.

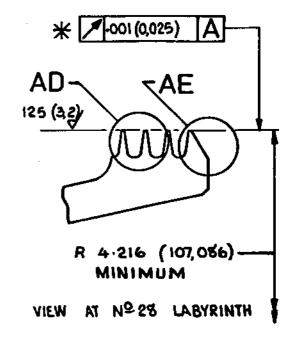


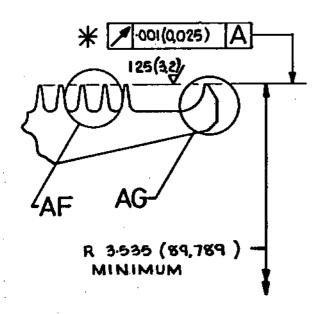
Standard Dimensions Figure 401

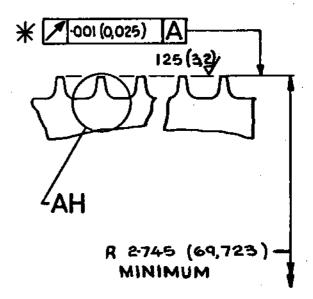
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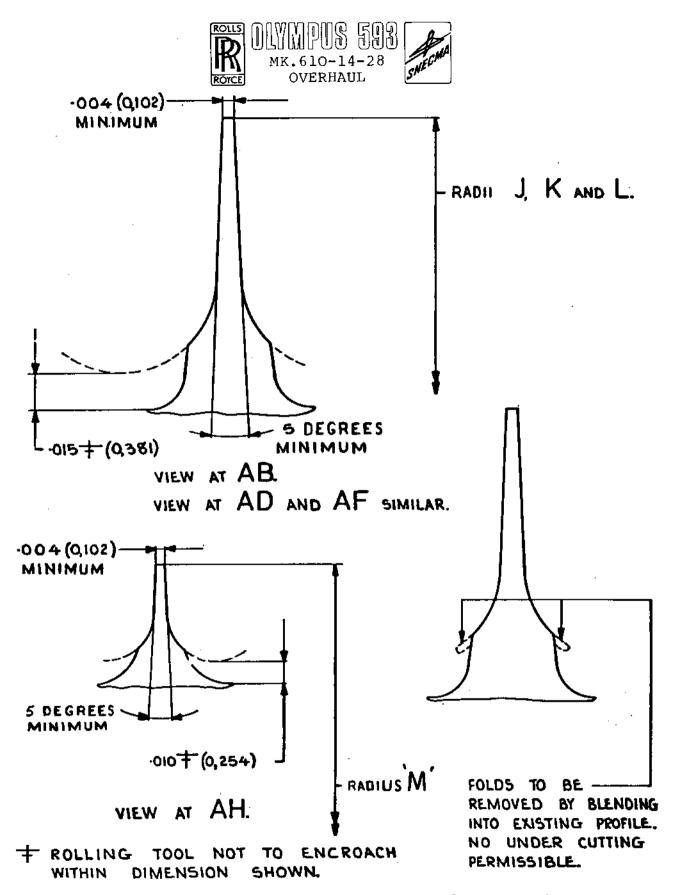
VIEW AT Nº29 LABYRINTH.

VIEW AT Nº30 LABYRINTH.

来 003 (0,076) LOCAL WITNESS IS IN ADDITION TO THESE TOLERANCES.

Machining Dimensions Before Roll Forming Figure 402

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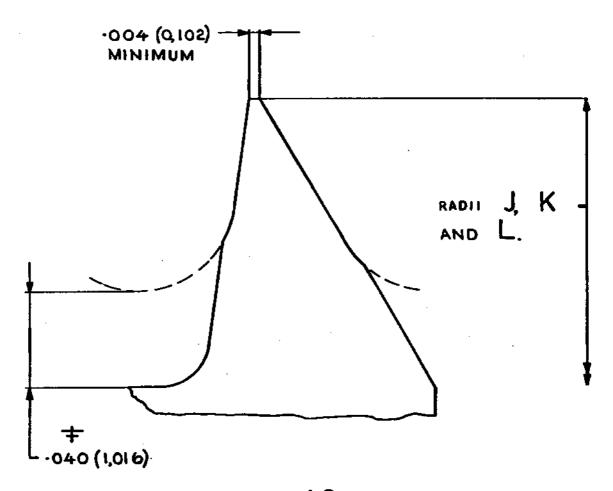
Roll Forming Dimensions and Fold Blending Detail Figure 403

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VIEW AT AC. VIEW AT AE AND AG SIMILAR.

Roll Forming Dimensions Figure 404

LP TURBINE ROTOR - REPAIR LABYRINTH RING FINS REPAIRED BY ROLL FORMING

Applicable to:

Labyrinth Ring B.922552

Authority:

Modification No. OL.836OC

1. Introduction

- A. This Repair describes the procedure for restoring defective labyrinth ring fins, in order to maintain the standard fin/housing clearances of labyrinth No.25. The diameter of each fin is first increased by roll forming then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the roll forming technique applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETRES).

2. Repair Limitations

- A. This Repair may be applied once only.
- B. Fins which have previously been repaired by welding must not be restored by roll forming.
- C. Verify that there is adequate material at each defective location to permit machining to the dimensions before roll forming (Ref.para.3.B.).

3. Summary of Operations

- A. Locate the shaft in fixture (Item 6) and set true in centre-lathe on datum holes A and flange face B (Ref. Fig. 401).
- B. Clean up defective fins; remove only the minimum amount of material to achieve the specified dimensions (Ref. Fig. 402). A localised "witness", not exceeding 0.003 in. (0,076 mm) is acceptable on each fin.

72-52-02



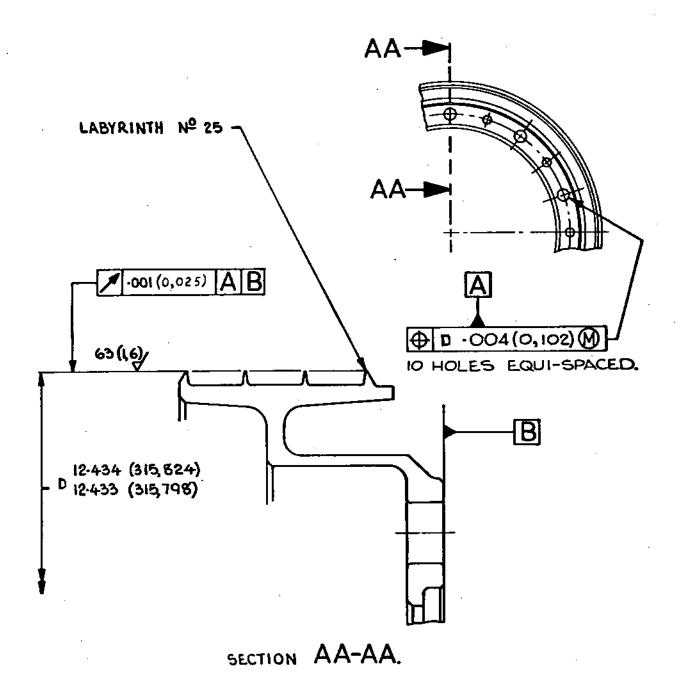
- C. Carefully remove any burrs.
- D. Apply the roll forming technique to increase the diameter of defective fins to the roll forming dimensions (Ref.Fig.403 and Fig.404).
- E. Remove any folds by careful blending (Ref.Fig. 405).
- F. Crack test the shaft with fluorescent-penetrant.
- G. Finish machine the fins (Ref.Fig.401); a maximum of 1.000 in. (25,4 mm) of the circumference which has not cleaned up is acceptable on each fin.
- H. Polish the fins to remove sharp edges.
- J. Repeat the test for cracks (para.F).
- K. Vapour blast the rotor shaft; use grit mesh 320/400.
- L. Identify repair. Mark the repair scheme number SAL B.478112 close to the standard part number on the labyrinth ring.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | Item |
|--|-----------------------|---|----------------------------|
| Tool Holder Rolling Tool Roller Roller Shims Fixture | 1 1 2 4 1 | \$3\$.12358000 \$3\$.12363000 \$3\$.12371000 \$3\$.12381000 \$3\$.12375-78000 \$3\$.12369000 | 1 2 3 4 5 6 |

Replacement Parts

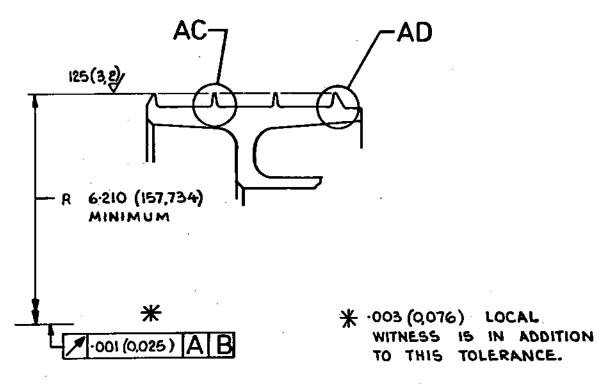
A. Not required.



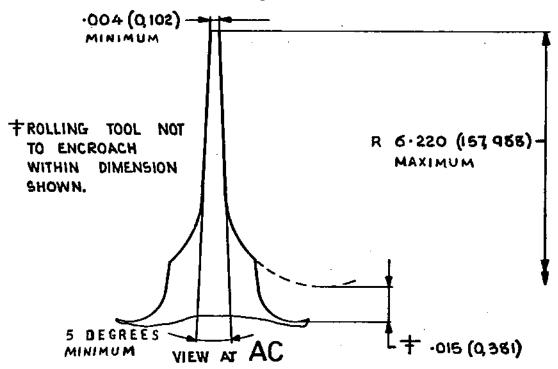
Standard Dimensions Figure 401

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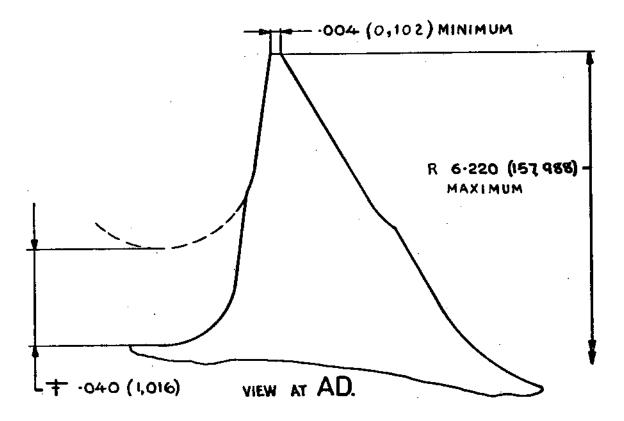
Dimensions Before Roll Forming Figure 402

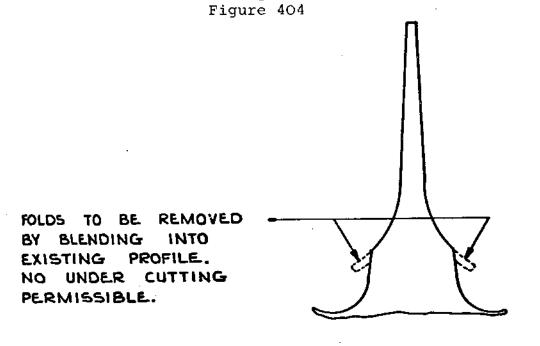


Rolls Forming Dimensions Figure 403

REPAIR

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Roll Forming Dimensions

Fold Blending Details Figure 405

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LP TURBINE ROTOR - REPAIR LABYRINTH HOUSING SEAL LANDS REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable_to:

Labyrinth Housing B.922553

Authority:

Modification No. OL.8360C

1. Introduction

- A. This Repair describes the procedure for restoring the labyrinth housing seal lands, in order to maintain the standard fin/housing clearances of labyrinth No.26. Each defective location is first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETRES).

Repair Limitations

- A. One seal location, or both, may be restored at one repair.
- B. Verify that there is adequate material at defective locations to permit machining to the dimensions before spraying (Ref.para.3.B.).

3. Summary of Operations

- A. Locate the labyrinth housing in fixture (Item 1) and set true in centre-lathe on datum diameter A and flange face B (Ref.Fig. 401).
- B. Machine defective locations to the specified dimensions (Ref.Fig.402); a "witness" of grooves is acceptable after machining.
- C. Crack test the labyrinth housing with fluorescentpenetrant.

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- D. Apply Abradable Coating (Ref.Fig.403).
 - (1) Combustion spray each prepared seal land with a bond coating of Metco 450, 0.003 in./0.004 in. (0,076 mm/ 0,102 mm) in thickness.
 - (2) Plasma spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating 0.030 in. (0,762 mm) in thickness over the bond coating.
- E. Refit the housing in fixture (Item 1) and set true in lathe; finish machine the seal lands (Ref.Table 401 and Fig. 401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Identify repair (Ref. Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the labyrinth housing.

| REPAIR SCHEME NO. | BORE LOCATION | DIAMETER 'H' (REF.FIG.401) |
|-------------------------|------------------|---|
| SAL B.478114 | , M, | 7.121 (180,873) 7.120 (180,848) |
| SAL B.478115 | 1 X 1 | 6.041 (153,441) 6.040 (153,416) |
| • | | , |

Standard Dimensions Table 401

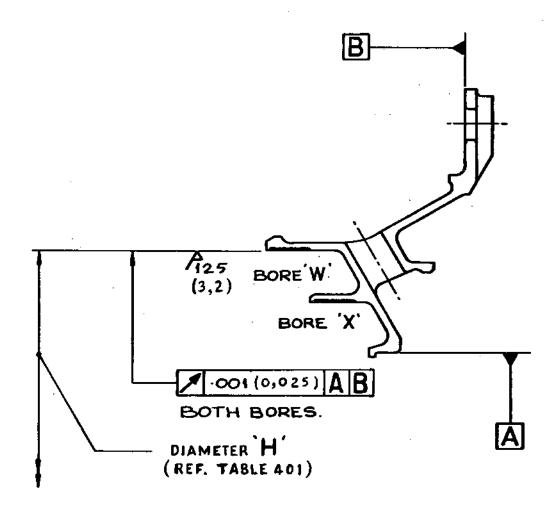
4. Special Tools, Fixtures and Equipment

| Description | <u>Quantity</u> | Tool No. | <u> Item</u> |
|-------------|-----------------|----------------|--------------|
| Fixture | 1 | \$3\$.12355000 | 1 |

5. Replacement Parts

A. Not required.

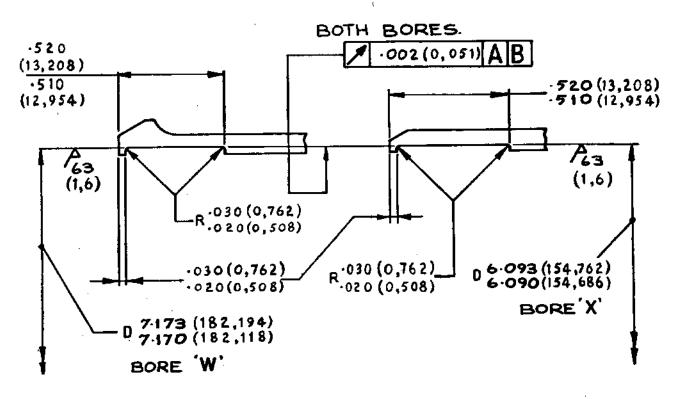




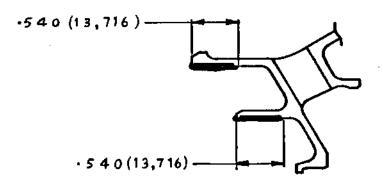
Standard Dimensions Figure 401

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Dimensions Before Spraying Figure 402



OVERSPRAY IS PERMISSIBLE ON END FACES ONLY, AND MUST NOT EXTEND BEYOND DIMENSIONS SHOWN. ALL OVERSPRAY IS TO BE REMOVED.

Spraying Detail Figure 403

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LIGHT IMPACT AND OTHER DAMAGE

MODIFICATION NO. OL. 8740C

1. Effectivity

| <u> I.P.C.</u> | <u>Fiq./Item</u> | <u>Part No.</u> |
|----------------|------------------|--|
| 72-52-02 | 1 2500 | B.931818-30 B.933172-74 B.933185-6 |

2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER.

CMT CERTIFICATE NO.CMT104/8497541.

(1) This repair describes the procedure for removing light impact and other damage from the broached root forms of disks by blending using conventional hand tools.

- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETRES).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Operations detailed in this repair procedure that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.
- B. Repair Limitations.
 - (1) Damage to Loaded flanks (Ref.Fig.401) is not acceptable.

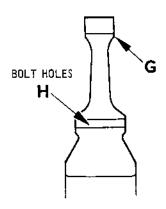
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- A SMALL AREAS, LIGHT IMPACT DAMAGE (FRONT OR REAR FACE)
- B CORNER, LIGHT IMPACT DAMAGE
- C LIGHT IMPACT DAMAGE
- D LIGHT SCRATCHES IN ROOT OR RELIEF, CAUSED BY LOCKING TAG
- E LIGHT FRET MARKS FROM BLADE TANG (FRONT FACE ONLY)
- F LIGHT DAMAGE ON UNLOADED FLANK
- G IMPACT DAMAGE ON RADIUSED EDGE (REAR FACE TO CONCAVE FACE)



Typical Damage Forms and Areas Figure 401

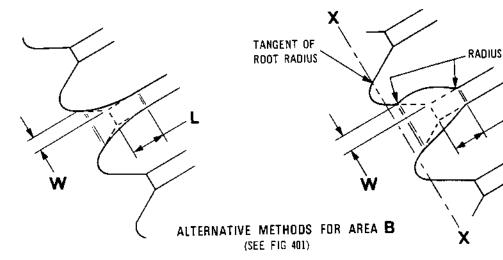
REPAIR

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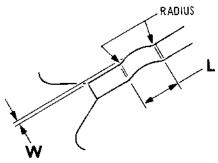


CR 35592/00A

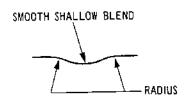


CONVEX RADIUS BLEND

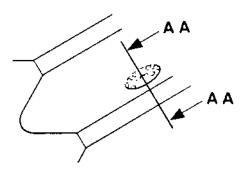
CONCAVE RADIUS BLEND



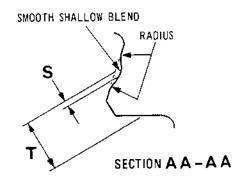
FOR AREA C (SEE FIG 401)



TYPICAL FOR AREAS A AND E (SEE FIG 401)



FOR AREA F (SEE FIG 401)



Blending Details Figure 402

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Blend depth maximums are as follows: (2)

Area (Ref.Fig.401)

Maximum Blend Depth (Ref.Fig.402)

А

0.005 in. (0.127 mm).

B and C For C, W max = 0.010 in. (0.25 mm)

'W x L' must not exceed 10% of the surface area of loaded flank face.

D and E (Critical Areas) 0.002 in. (0.05 mm).

F

Depth S not to exceed 10% of T.

G

0.010 in. (0.25 mm).

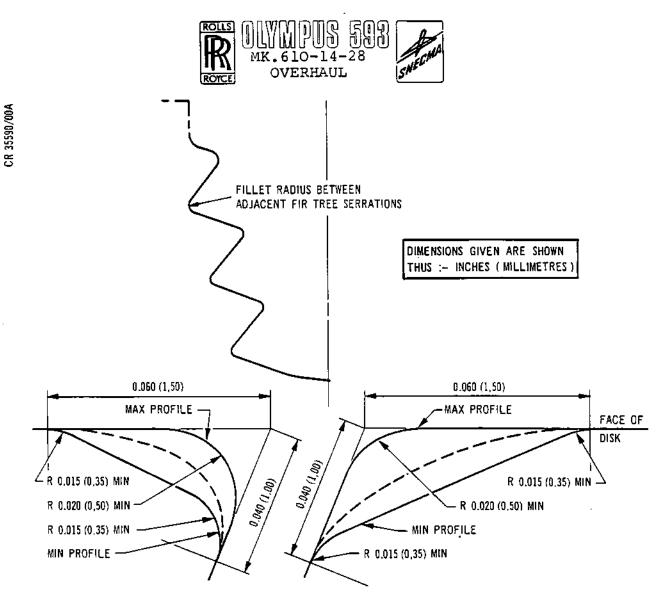
No blend to extend below XX (Ref.Fig.402).

<u>Instructions</u>

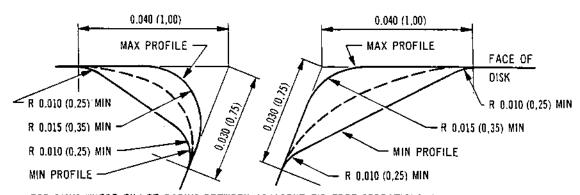
- Blend and Polish. Α.
 - Hand blend the damaged areas, in accordance with Overhaul Manual Chapter 72-09-22, Repair within limitations, to remove damage, using conventional hand tools and produce radii as required at intersection of blend and flank (Ref.Fig. 401 and 402). When blending area B the edge between the disk face and the serration must be radiused. The aim is to produce a radiused form, but a chamfer blended at the corners is acceptable, provided it falls within the dimensions shown in Fig. 403.
 - Polish areas blended to achieve a surface finish of 63 (2) micro inches (1,6 micrometers). Area D (Ref.Fig.401) must only be hand polished using fine grade emery cloth.
- Inspect. В.
 - Mask off bolt holes H (Ref.Fig.401) using a suitable (1) masking medium.
 - Locally etch the blended areas in accordance with the (2) procedure detailed in Chapter 72-09-14, Repair, using CMT solution C.

REPAIR

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FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS 0.35 (0.90) OR MORE



FOR DISKS WHERE FILLET RADIUS BETWEEN ADJACENT FIR TREE SERRATIONS IS LESS THAN 0.35 (0.90)

ACTUAL PROFILE TO LIE WITHIN ZONE BOUNDED BY MAXIMUM AND MINIMUM PROFILES AS SHOWN. BROKEN LINES INDICATE TYPICAL PROFILE.

Radiusing Fir Tree Serration/Disk Face Edge Figure 403

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- (3) Locally test the blended areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-52-02, Inspection/Check. CMT
- (4) Remove masking from bolt holes H (Ref.Fig.401).

C. Shot Peen.

- (1) Locally shot peen the blended areas using the following procedure and the details shown in Chapter 72-09-15.
- (2) Shot peening procedure.
 - (a) Process Classification: Controlled Shot Peen.
 - (b) Peening Medium:
 Steel Shot M.I.C. Grade M.I.170 4-8A Intensity.
 - (c) Peening Test Strip:
 VF 155 Type A.
 - (d) Arc Height: Method B = 0.004/0.008 in. (0.1/0.2 mm).
 - (e) Other Conditions:

Peening test strip check to be carried out immediately prior to peening each component or batch of components.

D. Identify.

(1) Using the vibro-percussion engraving technique Ref. Chapter 72-09-00, Repair, mark on SAL B.497541 or R4 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.

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- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.
- 4. Special Tools, Fixture and Equipment

None required.

5. Replacement Parts

None required.

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May 1/80



DISK, TURBINE, ROTOR, LP

BLENDING DAMAGE/DEFECTS IN BOLT HOLES

B499437

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig./Item</u> | <u>Part No.</u> |
|------------|------------------|--------------------------------------|
| 72-52-02 | 1 2500 | B930745-57 |
| | 1 2500 | B931818-28 B933172-4 B933185-6 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Only one blend per bolt hole is permissible. Blend may be at any radial position within bolt hole but must not occur outside the 0.750"(19,05) band extending from top of hole.

A maximum of fifty percent of the bolt holes in any LP turbine disk may be recovered using this repair technique.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO11D1 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125(3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

Hand blend damaged areas.
 Use conventional hand tools.

Refer Overhaul Manual Chapter 72-09-22 Repair. Refer to Repair Limitations. Refer to Figs. 401 and 402.

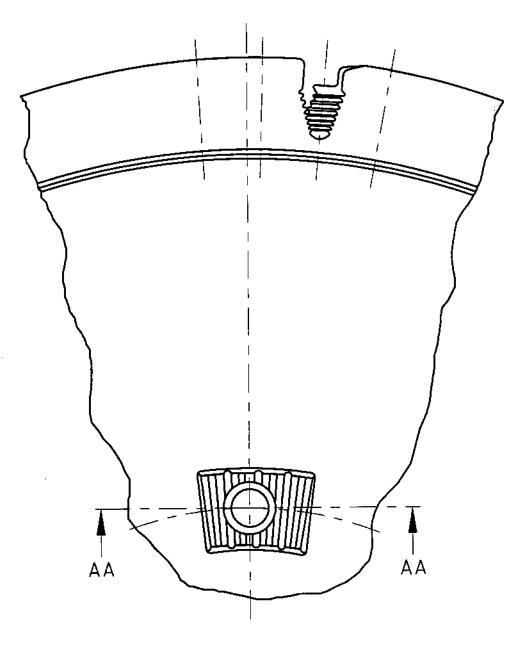
REPAIR

72-52-02 Repair No. 5 Page 401 Jun 1/97



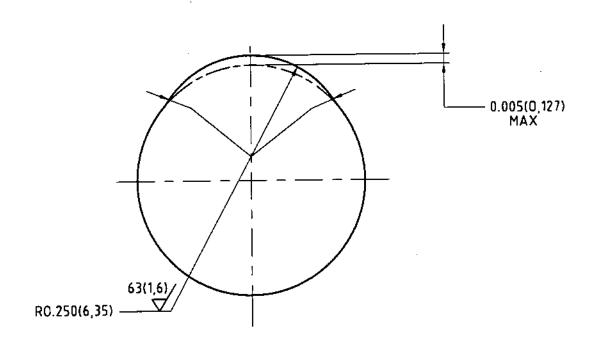
| 2) | Polish blended areas to required surface finish. | | Refer to Figs. | 401 and 402. |
|----|---|--|--|--------------|
| 3) | Locally etch blended are | eas. | Refer to Overh Chapter 72-09- using solution | 14 Repair, |
| 4) | Locally fluorescent dye penetrant inspect blende areas for cracks. | ∙d | Refer to Overh Chapter 72-52- /Check. | |
| 5) | Check holes using the eccurrent inspection method | ldy od. | Refer to Servi OL.593-72-8524 inspection pro | -242 for |
| 6) | Locally vapour blast etched areas. | | Refer to Overh Chapter 72-09- using procedur | 13 Repair, |
| 7) | Mark Repair Instruction RI B499437 or R5 on comp adjacent to normal 'asse number, using the vibro- percussion engraving tec Markings must be clear of blade slots by 0.030(0,7) | oonent, embly of' chnique. of the | Refer Overhaul Chapter 72-09- | |
| 5. | <u>MATERIAL</u> | | | |
| | COMPONENT | MATERIAL | | RR CODE |
| | DISK, TURBINE, ROTOR, LP. | WASPALOY MSRR7034 | | QDY |
| 6. | DATA | | | |
| | NONE. | | | |
| 7. | TOOLS | | | |
| | TOOL NUMBER DESCR | <u>IPTION</u> | | <u>item</u> |
| | NONE. | | | |
| 8. | REPLACEMENT PARTS | | | |
| | PART NUMBER DESCR | IP <u>TION</u> | QUANTITY | <u>ITEM</u> |
| | NONE. | | | |

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PART VIEW ON DISK FIG.401.

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ENLARGED SECTION THROUGH HOLE SHOWING DETAIL OF LOCAL BLENDING (TYPICAL)

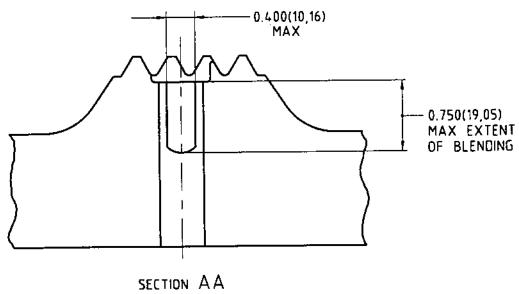


FIG.402.

REPAIR 72-52-02 Repair No. 5 Page 404 Jun 1/97



LP TURBINE DISKS - REPAIR BY BLENDING TO REMOVE LIGHT SCORES IN THE BORE AND ON FACES MODIFICATION NO. OL.8781C

Effectivity

| I.P.C. | Fig. | /Item | | Part No. |
|----------|------|-------|---|---|
| 72-52-02 | 1 | 250C | • | B.930745 B.930747-54 |
| | 1 | 250D | | B.931818 B.931820-27 B.933172 B.933174 B.933185 |

2. Introduction

A. General.

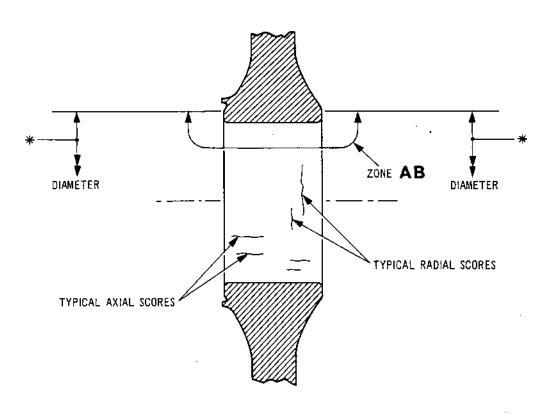
CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NO.CMT.104/B.499439.

- (1) This repair describes the procedure for blending light scores in the bore and on the faces of disks.
- (2) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETERS).
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.
- (5) Tolerances on dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Operations detailed in this repair procedure that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.

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CR 35813/00A



* DEFINED AS FULL EXTENT OF FACES

Blending Details Figure 401

72-52-02 Repair No.6 Page 402 Sep 1/81



- Repair Limitations. В.
 - A maximum of ten scores in faces and bore, within the area defined as AB (Ref.Fig.401), with a maximum depth of 0.005 in. (0,13 mm) by 0.250 in. (6,35 mm) long may be blended.

<u>Instructions</u> 3.

- Blend and Polish.
 - Hand blend the damaged areas, in accordance with Overhaul Manual Chapter 72-09-22, Repair within limitations, to remove scores, by polishing with fine grade emery cloth. Blends must be smooth, continuous, free from scratches and polished to achieve a surface finish of 63 microinches (1,6 micrometers).
- Inspect. в.
 - Locally swab etch the blended areas in accordance (1) with the procedure detailed in 72-09-14, Repair, CMT using Solution C.

- Locally test the blended areas for cracks using the (2) fluorescent dye penetrant process specified for this component in 72-51-03, Inspection/Check. CMT
- Vapour Blast.
 - Locally vapour blast the etched areas in accordance with 72-09-13, Repair, using procedure B. Overblast CMT is acceptable.
- Identify. D.
 - Using the vibro-percussion engraving technique Ref.72-09-00, Repair, mark on SAL. 8.499439 or R6 adjacent the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.
- Finally Inspect.
 - Finally inspect the disk to ensure the repair has been carried out satisfactorily and that the disk is in a serviceable condition.

REPAIR



- 4. Special Tools, Fixtures and Equipment
 None required.
- Replacement Parts
 None required.

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LP TURBINE DISK - REPAIR BY BLENDING TO REMOVE FRET MARKS ON FRONT FACE MODIFICATION NO. OL.8785C

1. Effectivity

| I.P.C. | <u>Fig.</u> | /Item | Part No. |
|----------|-------------|-------|--|
| 72-52-02 | 1 | 250C | B.930745 B.930747 to B.930754 |
| | 1 | 250D | B.931818 B.93182D to B.931827 B.933172 B.933174 B.933185 |

2. Introduction

A. General.

CAUTION: THIS PROCEDURE CONTAINS OPERATIONS THAT ARE SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NO.CMT 104/B.499469.

- (1) This repair describes the procedure for removing fret marks from the front face of the disk.
- (2) Refer to 72-09-00, Repair for all standard practices applicable to this repair procedure.
- (3) Operations that are subject to Component Manufacturing Technique Control are identified by the initials 'CMT'.
- B. Repair Limitations.
 - (1) Blends must not exceed the dimension shown in Fig.401.

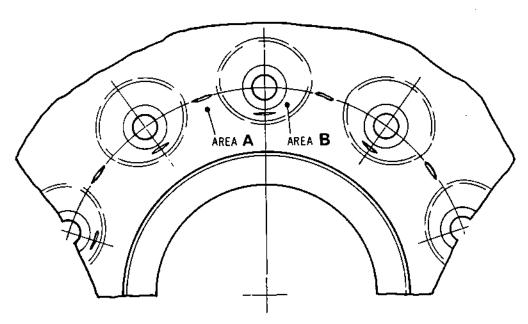
3. Instructions

- A. Blend and Polish.
 - (1) Hand blend, in accordance with Overhaul Manual Chapter 72-09-22, Repair to remove fret marks within the limits shown in Fig. 401. Blends must be smooth, continuous, free from scratches and polished to achieve a surface finish of 63 micro-inches (1,6 micrometres).

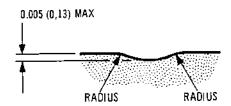
CMT

REPAIR

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VIEW ON FRONT FACE OF DISK



TYPICAL BLEND FOR AREAS A AND B

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Blending Details Figure 401

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B. Inspect.

- Locally etch blended areas.
 - (a) Blank off bolt-holes which are located near areas to be etched.
 - (b) Swab etch the blended areas in accordance with the procedure detailed in 72-09-14, Repair, using solution C.

CMT

(2) Inspect the blended areas for cracks by the fluorescent dye penetrant method using the process recommended for this component in 72-52-02, Inspection/Check.

CMT

- C. Vapour Blast.
 - (1) Locally vapour blast the etched areas in accordance with procedure B (Ref.72-09-13, Repair).

CMT

- D. Identify.
 - (1) Using the vibro-percussion engraving technique Ref.72-09-00, Repair, mark on SAL B.499469 or R7 next to the existing part number. Markings must be clear of the blade slots by 0.030 in. (0,75 mm) minimum.
- E. Finally Inspect.
 - (1) Finally inspect the disk to ensure that the repair has been carried out satisfactorily and that the disk is in a serviceable condition.



LP TURBINE ROTOR - REPAIR OF NO.25 LABYRINTH FINS BY PLASMA OR TIG WELDING

MODIFICATION NO. 01.8807C

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u> 72-52-02 1 100 B.922552

2. <u>Introduction</u>

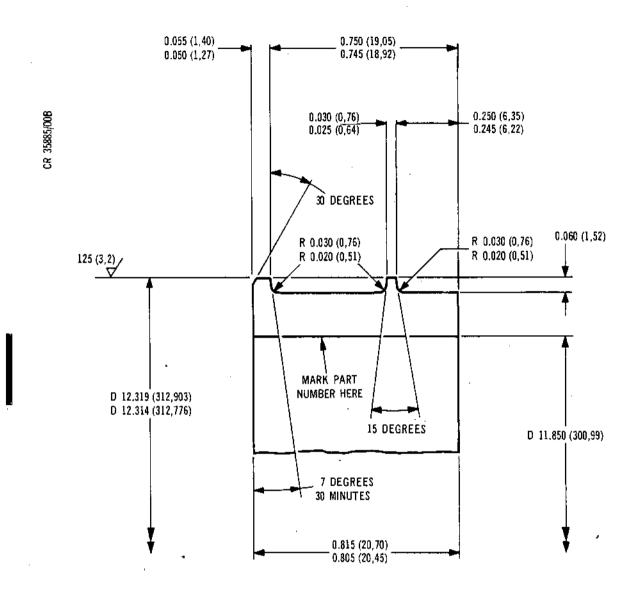
A. General.

- (1) This repair describes the procedure to be followed in order to restore the fins of No.25 labyrinth seal to a serviceable condition after they have become worn or damaged.
- (2) Refer to 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (3) Prior to commencing weld build-up repair work on No.25 labyrinth seals, a test piece having the same geometry as the standard component must be prepared and then metallurgically examined. A new test piece will be required upon any change of airline operator, sub-contractor, machine or welding equipment involved with the repair of labyrinth seals to the requirements of this procedure. A standard component may be used as a test piece.
- (4) Remove burrs and sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined surfaces are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 63 microinches (1,6 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in this procedure are detailed in paragraph 5.



3. <u>Preparation and Use of Test Piece</u>

- A. Machine Test Piece.
 - (1) Produce a test piece in fully heat treated MSRR 7034 material to the dimensions shown in Fig.401. Alternatively, an unserviceable, standard No.25 labyrinth seal machined to the dimensions shown (Ref.Fig.402) may be used as a test piece. If an unserviceable standard labyrinth is to be used, carry out the machining with the component installed in the holding fixture (Ref.tool item 1)
 - (2) Remove sharp edges from the fins.
- B. Build up Fins on Test Piece.
 - (1) Use the plasma welding technique detailed in 72-09-12 Repair or mechanised TIG welding as detailed in TSD 594 OP 409, in conjunction with the welding data detailed in paragraph 7 and build up the fins on the test piece as follows:
 - (a) Carry out the first weld run without wire and continue with eight weld runs on each fin, with wire.
 - (b) Allow the test piece to cool for 10 to 15 minutes between each weld run.
 - (c) Weld build up must not be less than 0.080 in. (2,032 mm).
- C. Identify.
 - (1) Mark B500234 on the test piece using vibropercussion marking as specified in Chapter 72-09-00 Repair.



SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN
THUS :- INCHES (MILLIMETRES)

Test Piece Manufacturing Details Figure 401

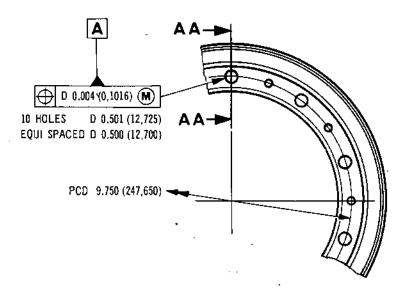
72-52-02

Repair No.8

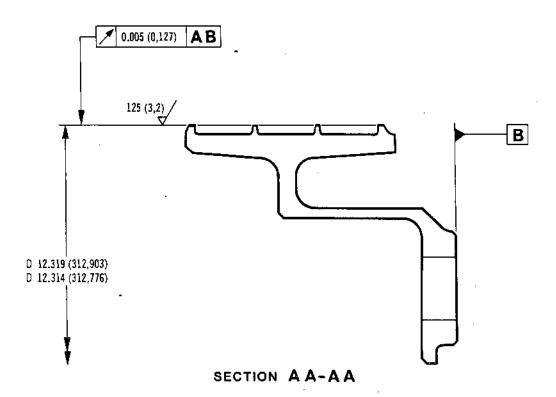
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DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)



Pre-Weld Machining Dimensions Figure 402

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- D. Examine Test Piece (Ref.Fig.403)
 - (1) Produce four micro sections from the test piece at 90 deg to the weld surface.
 - (2) Subject the micro sections to a VPN hardness check using a 5 kg load and a 2/3 objective in 0.020 in. (0,508 mm) increments.
 - (3) Check that the heat affected zone is within the limit shown.

4. Repair Labyrinth No.25

- A. Machine Labyrinth.
 - (1) Install the holding fixture (Ref. tool item 1) on a centre lathe and set true to datum diameter.
 - (2) Locate and clamp the labyrinth to the holding fixture.
 - (3) Finish turn the labyrinth to the dimensions shown (Ref.Fig.402).
 - (4) Remove the fixture and component from the lathe and detach the component from the fixture.
 - (5) Remove burrs and sharp edges.
 - (6) Inspect the machined areas for cracks using the fluorescent dye penetrant process specified for this component in Chapter 72-52-02 Inspection/Check.
- B. Build up Labyrinth Fins.
 - (1) Use the plasma welding technique detailed in 72-09-12 Repair or mechanised TIG welding as detailed in TSD 594 OP 409, in conjunction with the welding data detailed in paragraph (7) and build up the fins as follows:
 - (a) Carry out the first weld run without wire and continue with eight weld runs on each fin, with wire.



0.815 (20,70)
0.805 (20,45)

0.755 (19,18)
0.750 (19,05)

0.255 (6,48)
0.250 (6,35)

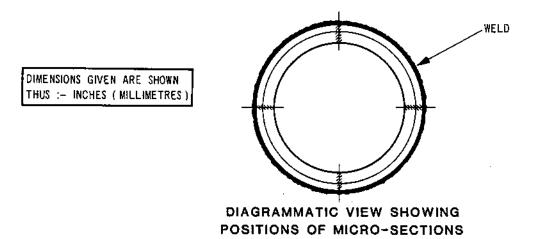
0.005 (0,127)

PRA

O.080 (2,032) MIN
VPN HARDNESS
TRAVERSE

0.050 (1,27) MAX LIMIT
OF HEAT AFFECTED ZONE

MICRO-SECTION OF TEST PIECE



Welding and Hardness Check Details Figure 403

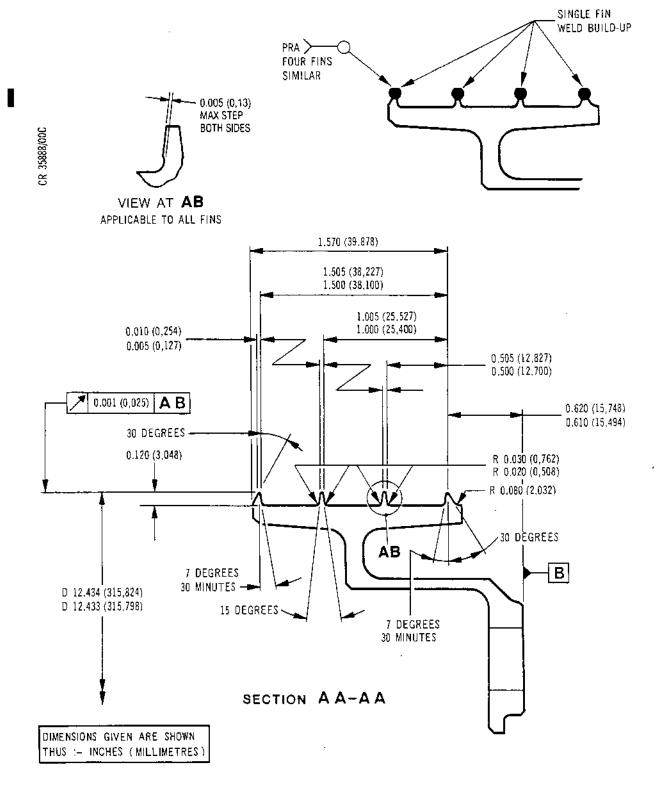
72-52-02 Repair No.8 Page 406 Jun 1/90

1K.610-14-28 snecma OVERHAUL

- (b) Allow the component to cool for 10 to 15 minutes between each weld run.
- (c) Weld build up must not be less than 0.080 in. (2,032 mm).
- (2) Inspect.
 - (a) Visually inspect to ensure that the weld is satisfactory.
 - (b) Carry out dimensional checks to ensure that sufficient weld depth has been deposited.
- (3) Inspect the labyrinth for cracks using the fluorescent dye penetrant crack detection process specified for this component in 72-52-02, Inspection/Check.
- C. Machine Labyrinth Fins (Ref.Fig.404).
 - (1) Install the holding fixture (Ref. tool item 1) on a centre lathe and set true to datum diameter.
 - (2) Locate and clamp the labyrinth to the holding fixture.
 - (3) Finish turn to obtain the fin diameter of 12.434 to 12.433 in. (315,824 to 315,798 mm).
 - (4) Finish turn to remove any surplus plasma spray from the surface.
 - (5) Finish turn to form labyrinth fins to the dimensions shown using form tools (Ref. tool items 2 and 3).
 - (6) Remove the component from the machine and remove burrs and sharp edges.
 - (7) Visually and dimensionally inspect the labyrinth to ensure that machining has been satisfactorily completed.
- D. Heat Treat
 - (1) Heat the labyrinth to 760 deg C (plus/minus 10 deg C) for 16 hours in a vacuum furnace. Cool using gas fan quench.

REPAIR





Labyrinth No.25 - Final Machining Dimensions Figure 404

REPAIR

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- E. Etch Repaired Labyrinth Fins.
 - (1) Swab etch the labyrinth fins using solution C. Refer to 72-09-14, Repair, for the procedure and details of solution.
- F. Inspect.
 - (1) Inspect the labyrinth for cracks using the fluorescent dye penetrant process specified for this component in 72-52-02, Inspection/Check.
 - G. Vapour Blast Etched Fins
 - (1) Vapour blast the fins in accordance with 72-09-13, Repair, using procedure B.
 - H. Identify Repair.
 - (1) Mark salvage B.488619 or R8 close to the existing part number using the vibro-percussion or electrochemical marking technique as specified in 72-09-00, Repair.
- J. Inspect the Labyrinth.
 - (1) Carry out a final visual inspection and dimensional check of the labyrinth.
 - 5. Special Tools, Fixtures and Equipment
 - A. The following tools, fixtures and equipment are required to complete this repair.

| <u>Description</u> | Tool No. | <u>Item</u> |
|--------------------|---------------|-------------|
| Holding fixture | \$3\$12369000 | 1 |
| Form tool | S3S12805000 | 2 |
| Form tool | \$3\$12808000 | 3 |

6. Replacement Parts

None



7. <u>Welding Data</u>

A. Plasma Weld.

Material: Weld geometry:

weld geometry:

Filler wire:

Feed rate (wire): Machine:

Welding current:

Plasma gas (torch):

Shield gas (torch):

Weld speed:

Nozzle:

Electrode:

Arc length:

Waspaloy

Circumferential MSRR 9500/202

26 swg (0.018 in. (0,46 mm)

diameter)

40 in. (1041 mm) per minute

Union Carbide 100 amp with fine wire feed

25 to 28 amp

Argon 0.2 cu ft/h at 30 psi

(0.094 l/min at 207 kPa) Argon +5% H₂ 15 cu ft/h at

30 psi (7 l/min at 207 kPa) 5.5 in./min (140 mm/min) on

Rotorn variable control

turntable

Orifice diameter 0.052 in.

(1,321 mm)

3/32 in. (2,3812 mm) diameter

thoriated tungsten 0.150 in. (3,81 mm)

3. Mechanised TIG Welding.

Material

: Waspaloy

Weld Process

: Hobart Dabber Welder System

Weld Current

400 DC

Amperage

: 100 Amp

Weld Preparation

Machined Surface, Degrease

using MEK

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

Shielding Gas

: Argon

Gas Flow Rate

: 35 CFH (991,5 L/h)

Trailing Gas

:

Gas Flow Rate

:

72-52-02

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Voltage (AVC) : 7.5

Deadband : 4

Sensitivity: 3

Lock Out : No

Retract Distance : 0

Starting Arc Gap : 0.05

Start Delay : 1.5

Welding Current

Fusion Mode : Pendant Setting 24 Amps

Weld Mode : Pendant Setting 26.5 Amps

Filler Material Spec. : MSRR 9500/202 (AMS 5828)

Size : .030 in. (0,76 mm) dia.

Feed Rate : 8.8 IPM (224 mm/min.)

Filler Wire Start Delay : 1.3

Filler Wire Stop Delay : 0.1

Dabber Strokes/Min : 310

Stroke Length : 0.470 in. (12 mm)

Pulsation : No

Weld Speed

Fusion Mode : 6.4 IPM (162,5 mm/min.)

Weld Mode : 6.4 IPM (162,5 mm/min_)

Increasing to 10.0 IPM

(254 mm/min.) as Fin Height

Progresses

NOTE: All readings shown are machine dial readings unless otherwise indicated.

COMMENTS: Set table at 90°, wire brush after each weld deposit.

72-52-02

Repair No.8

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OVERHAUL

LP TURBINE HUB ASSEMBLY - LABYRINTH NO'S.27 TO 30 RESTORED BY TIG WELDING

MODIFICATION NO. OL.8899C

<u>Effectivity</u> 1.

| IPC | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|----------------------|
| 72-52-02 | 1 210 | B.922662 B.922296 |

<u>Introduction</u> 2.

General.

THIS PROCEDURE CONTAINS OPERATIONS THAT ARE CAUTION: SUBJECT TO COMPONENT MANUFACTURING TECHNIQUE (CMT) CONTROL. THESE OPERATIONS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE MANUFACTURER. CMT CERTIFICATE NUMBER CMT 120/B488628 to 31.

- (1) This repair describes the procedure for restoring the labyrinths number 27, 28, 29 and 30 by mechanised TIG welding and machining to standard dimensions.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES) in tables and illustrations.
- Refer to Chapter 72-09-00, Repair for all standard (3) practices applicable to this repair procedures.
- (4) The operations that are subject to Component Manufacturing Technique control are indicated CMT.
- A test piece shall be produced and subjected to (5) metalurgical examination; test pieces are required initially and upon any subsequent change of airline operator, sub-contractor, machine or locallity. Test pieces are also required after every ten component repairs or annually, where time elapsed between component repairs exceeds one year.
- (6) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (7) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.

REPAIR

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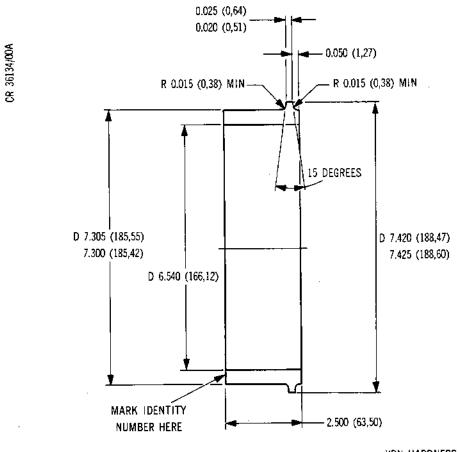
- (8) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (9) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (10) All tools referred to by item number in procedural steps are detailed in para.5.
- (11) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

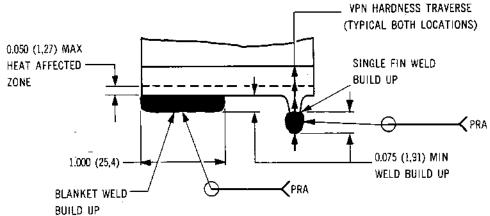
3. Test Piece

- A. Produce Test Piece.
 - (1) Produce a test piece from fully heat-treated MSRR.7084 material to the dimensions given in Fig.401.
 - (2) It is permissible to use an unserviceable standard part as a test piece. In this case, machine the labyrinth fins to the dimensions given in Fig. 403 and 404.
 - (3) Remove sharp edges from the fins.
 - (4) Inspect for cracks using the F2A fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Checks.
- B. Weld Test Piece.
 - (1) Build up the single fin to a minimum height of 0.075 in. (1,91 mm) as indicated in Fig.401 by mechanised TIG welding using fitler rods 0Mat 3/99 as instructed in TSD 594 OP 409.
 - (2) Build up the blanket weld with a single weld run only, as indicated in Fig. 401 by mechanised TIG welding using filler rods Omat 3/99 as instructed in TSD 594 OP 409.

REPAIR

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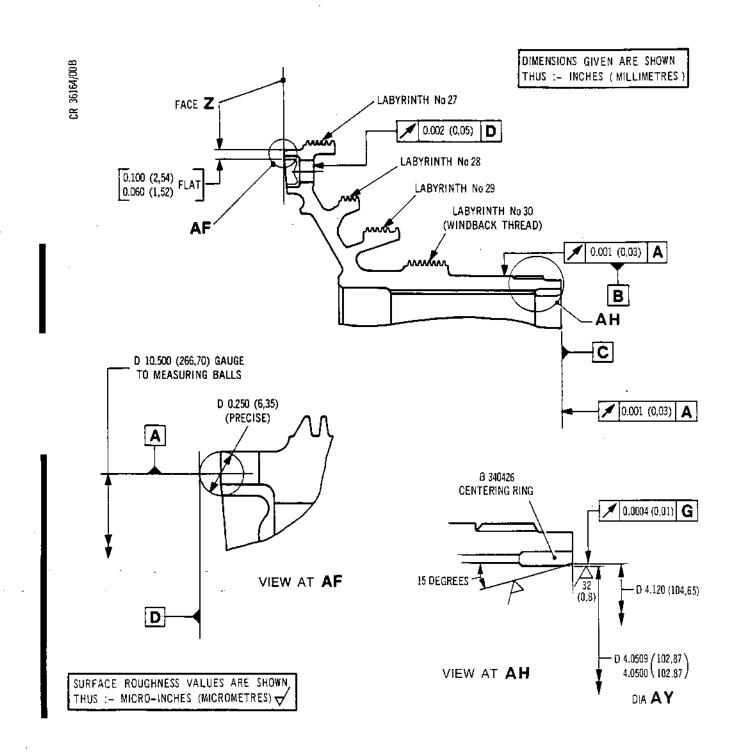




DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Test Piece Details Figure 401

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LP Turbine Rotor Hub Figure 402

REPAIR

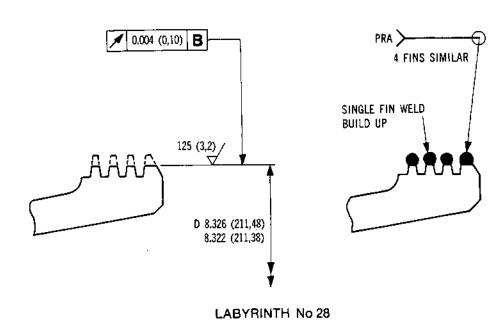
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0.004 (0,10) B

Single fin weld Build UP

D 11.050 (280,67) 11.046 (280,57)

LABYRINTH No 27



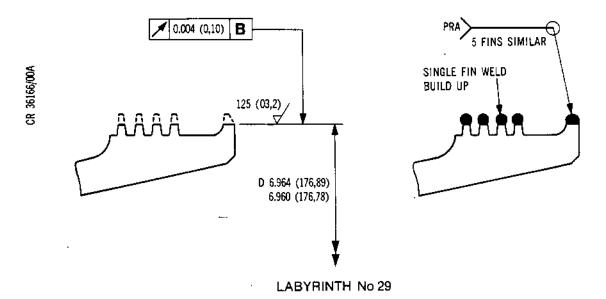
SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

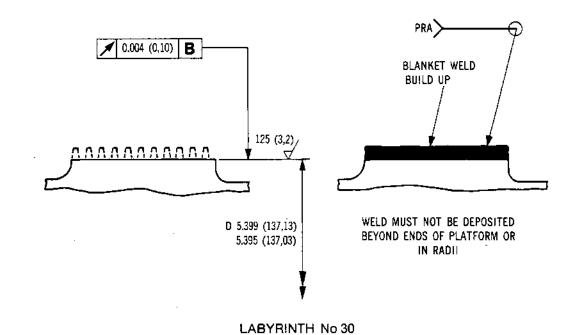
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Labyrinth No.27 and 28 Machining and Welding Details Figure 403

72-52-02 Repair No.9 Page 405 Dec 1/88







SURFACE ROUGHNESS, VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Labyrinth No.29 and 30 Machining and Welding Details Figure 404

REPAIR 72-52-02 Repair No.9 Page 406 Dec 1/88

C. Machine.

(1) Locate the test piece in a lathe and machine the blanket weld only, removing the minimum material, until the surface is free of defects, e.g. voids, porosity, etc.

D. Inspect.

(1) Inspect for cracks using the FIA fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check.

E. Weld.

(1) Repeat operations in paras. 3B(2) to 3D until the minimum build-up is achieved without defects (Ref.Fig.401).

F. Heat Treat.

(1) Heat treat the test piece in argon gas at 760 deg.C plus/minus 10 deg.C for 16 hours. Cool in air.

G. Identify.

(1) Mark B497476 on the test piece using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.

H. Inspect.

(1) Inspect the blanket weld only, using the ultrasonic C-scan process as specified in Chapter 72-09-00 Inspection/Check.

J. Metallurgical Examination.

<u>NOTE:</u> The following examination must be carried out by the controlling laboratory.

- (1) Produce four suitable micro-sections at 90 deg. from the test piece surface.
- (2) Subject the micro-sections to a VPN hardness check using a 5 kg load and 2/3 rds objective at 0.020 in. (0,51 mm) increments, traversed across the micro-sections. Check that the heat affected zone is limited to the area shown in Fig.401 (test piece) or Fig.411 (unserviceable standard part).

REPAIR

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4. <u>Instructions</u>

- A. Machine.
 - (1) Remove centering ring from hub.
 - (2) Locate the holding fixture ref. tool item 3, to a lathe, and set true.
 - (3) Locate the hub assembly on the fixture and set true.
 - (4) Machine the seal fins of the No.27, 28, 29 and 30 labyrinths to the dimensions given in Fig. 403 and 404.
 - (5) Remove burrs and sharp edges.
- B. Inspect.
 - (1) Inspect for the satisfactory completion of the machining operation.
 - (2) Dimensionally inspect centering ring location. Refer to Chapter 72-52-02 Inspection/Check.
 - (3) Inspect for cracks using the fluorescent dye penetrant process detailed for this component in Chapter 72-52-02 Inspection/Check. CMT
 - (4) Measure and record the position of the fins on the labyrinths 27, 28 and 29 (Ref. Fig. 405, 406 and 407).

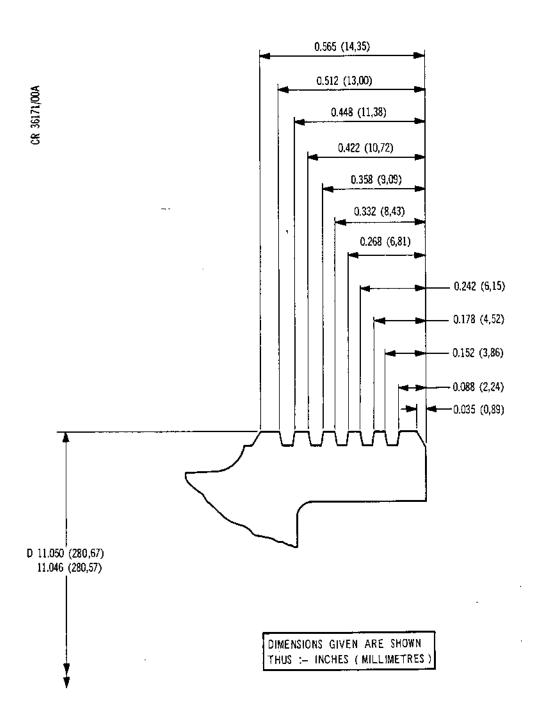
C. Weld.

- (1) Build-up the fins of the No.27, 28 and 29 labyrinths as indicated in Fig.403 and 404, by mechanised TIG welding using filler rods 0Mat 3/99 as instructed in TSD 594 OP 409. Weld build-up must be sufficient to allow finish dimensions to be achieved (Ref.Fig.402, 408 and 409). Refer to para.7 for welding details.
- (2) Build-up the No.30 labyrinth location as indicated in Fig.404, by a single weld run only, using mechanised TIG welding with filler rods Omat 3/99 as instructed in TSD 594 OP 409. Refer to para.7 for welding details.
 CMT

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REPAIR

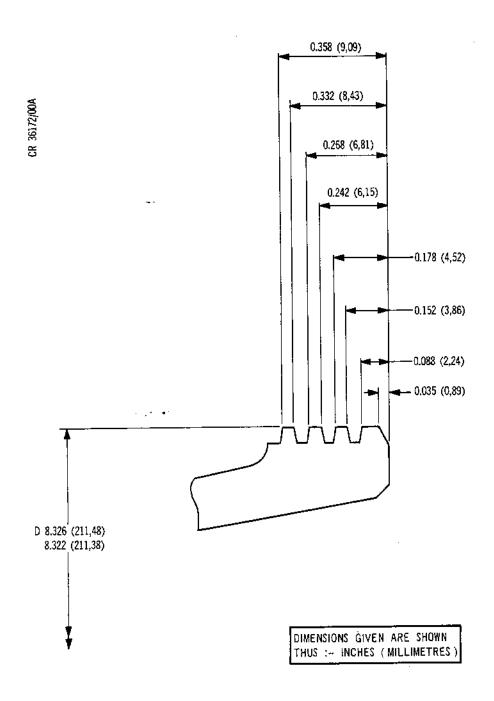
Jan 31/94



Reference Dimensions Figure 405

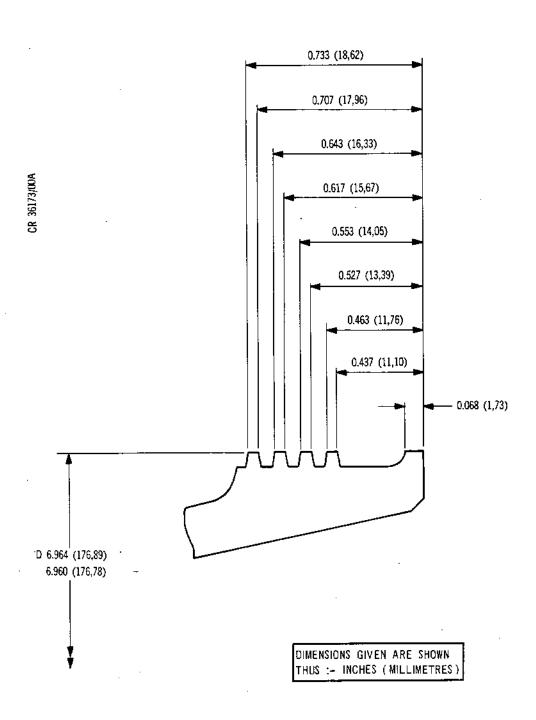
72-52-02 Repair No.9 Page 409 Dec 1/88





Reference Dimensions Figure 406

72-52-02 Repair No.9 Page 410 Dec 1/88



Reference Dimensions Figure 407

D. Machine.

- (1) Locate the hub assembly to the holding fixture reftool item 3, on the lathe and set true.
- (2) Machine the No.30 labyrinth seal location, removing the minimum material, until the surface is free of all defects, e.g. voids, porosity etc.

E. Inspect.

(1) Inspect the No's.27, 28,29 and 30 seal locations using the fluorescent dye penetrant process specified for this component in Chapter 72-52-02, Inspection/ Check.

F. Weld.

(1) Repeat the welding, machining and inspection operations for labyrinth No.30 only as instructed in paragraphs 4C(2), 4D and 4E, until sufficient material is built up to achieve the finish dimensions (Ref. Fig.402 and 410).

G. Inspect.

- (1) Inspect the hub assembly for distortion (Ref.Fig.402).
- (2) Inspect the welding as detailed in TSD 594 OP 409.

CMT

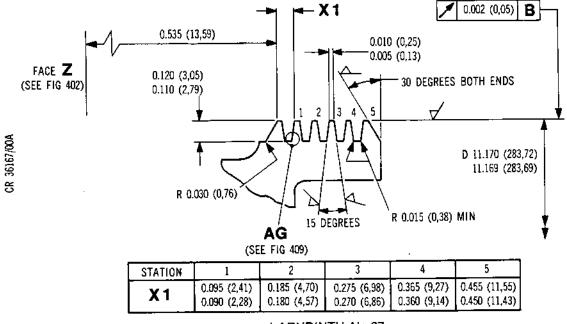
- (3) Inspect the hub assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-52-02 Inspection/Check. CMT
- (4) Inspect the No.30 labyrinth location using the ultrasonic C-scan process as specified in Chapter 72-09-00 Inspection/Check. CMT

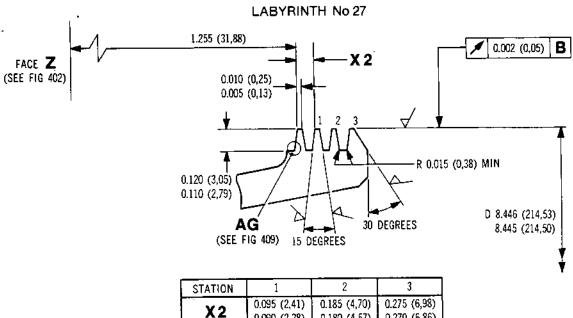
H. Machine.

(1) Locate the hub assembly to the holding fixture ref. tool item 3, on the lathe and set true.

REPAIR

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LABYRINTH No 28

0.180 (4,57)

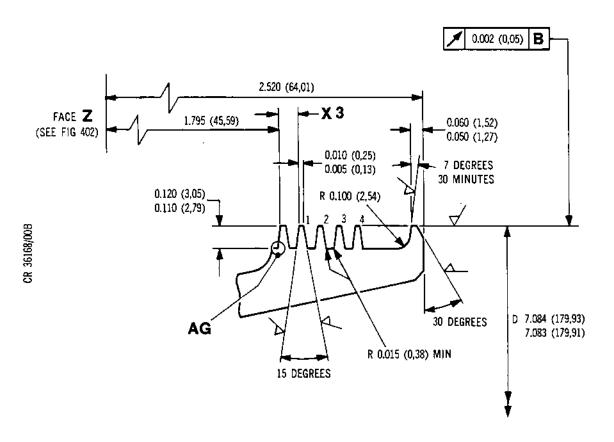
0.270 (6,86)

0.090 (2,28)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

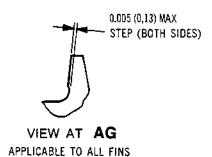
Labyrinth No.27 and 28 Machining Details Figure 408

REPAIR Repair No.9 Page 413 Dec 1/88



| STATION | 1 | 2 | 3 | 4 |
|---------|--------------|--------------|--------------|--------------|
| Х 3 | 0.095 (2,41) | 0.185 (4,70) | 0.275 (6,98) | 0.365 (9,27) |
| | 0.090 (2,28) | 0.180 (4,57) | 0.270 (6,86) | 0.360 (9,14) |

LABYRINTH No 29



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Labyrinth No.29 Machining Details Figure 409

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REPAIR

MK.610-14-28 snecma OVERHAUL

- (2) Finish machine the fins of No.27, 28 and 29 labyrinths using form tool ref. tool item 1, to the dimensions given in Fig.408 and 409. Use the dimensions previously recorded (para.48(3)) to ensure that the maximum step is 0.005 in. (0,13 mm) (Ref.Fig.409 view AG).
- (3) Finish machine the No.30 labyrinth (windback seal) using form tool ref. tool item 2, to the dimensions given in Fig.410.
- (4) Locate the hub assembly on a milling machine and set true for machining the existing scallops (Ref. Fig. 410).
 CMT
- (5) Machine to remove any weld deposit from the three existing scallops on the No.30 labyrinth, to the dimensions given in Figure 410.
- J. Heat Treat.

Heat treat the hub assembly in an inert gas or vacuum furnace at 760 deg.C plus/minus 10 deg.C for 16 hours. Rapid gas quench.

CMT

- K. Inspect.
 - (1) Inspect for the satisfactory completion of the machining operation and for distortion.
 - (2) Chemically etch the repaired areas as instructed in Chapter 72-09-14 Repair, using Solution C. CMT
 - (3) Inspect the hub assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-52-02 Inspection/Check.
 CMT
 - (4) Visually inspect centering ring and hub location.

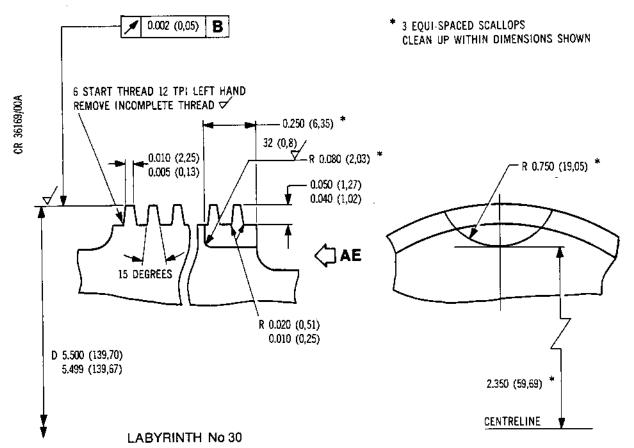
 Refer to Chapter 72-52-02 Inspection/Check. CMT
- L. Vapour Blast.
 - (1) Mask off the hub assembly with suitable waterproof masking tape. Ensure that only the repair area is exposed.
 - (2) Vapour blast the labyrinth fins as instructed in Chapter 72-09-13 Repair, using 320/400 mesh aluminium oxide grit at Almen 2N intensity.

CMT

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Repair No.9
Page 415
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REPAIR





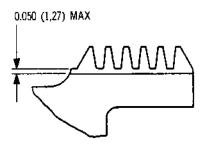
VIEW IN DIRECTION OF ARROW AE

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES) ✓

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

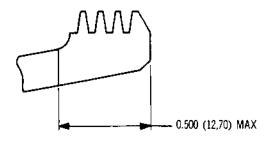
Labyrinth No.30 Machining Details Figure 410

REPAIR 72-52-02 Repair No.9 Page 416 Dec 1/88

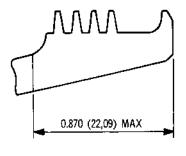


LABYRINTH No 27

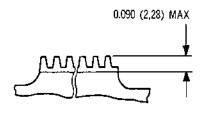
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



LABYRINTH No 28



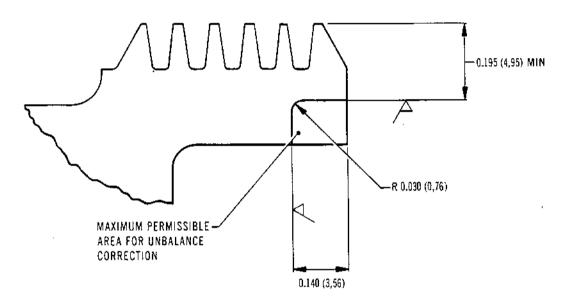
LABYRINTH No 29



LABYRINTH No 30

Maximum Heat Affected Zones Figure 411

REPAIR 72-52-02 Repair No.9 Page 417 Dec 1/88



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

DETAIL AK

Balancing Details Figure 412

REPAIR Repair No.9 Page 418 Jan 31/94 OVERHAUL

Balance. Μ.

- (1) Replace centering ring.
 - Heat ring to 100 deg.C plus/minus 10 deg.C and assemble.
 - (b) If new centering ring fitted, machine to dimensions shown (Ref.Fig.402, View on AH).
- With assembly located off diameters AX and AY, statically balance to a maximum initial unbalance of 25 drm/ins (1,125 grm/mm). Unbalance correction to be achieved by removal of material from the balancing positions (Ref. Figs. 402 and 412).

Inspect. - N -

Inspect the hub assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-52-02 Inspection/Check.

Р. Identify.

Mark the appropriate salvage number (Ref. Table 401) (1) adjacent to the existing part number, using vibro-percussion marking as specified in Chapter 72-09-00 Repair.

| SALVAGE NO. | LABYRINTH NO. | TEST PIECE |
|-------------|---------------|------------|
| B488628 | 27 | B497476 |
| B488629 | 28 | B497476 |
| B488630 | 29 | B497476 |
| B488631 | 30 | B497476 |

Table 401

Final Inspection. R.

Finally inspect the hub assembly to ensure that the repair has been carried out satisfactorily and that the hub is in a serviceable condition.



5. Special Tools, Fixtures and Equipment

| <u>Description</u> | Qty. | Part No. | <u>Item</u> |
|--------------------|------|--------------|-------------|
| Form tool | 1 | S3S 15511000 | 1 |
| Form tool | 1 | S3S 15510000 | 2 |
| Holding fixture | 1 | S3S 14788000 | 3 |

Replacement Parts

None.

7. Welding Machine Data

A. Labyrinth Fin No.27 (Individual).

Material

: Waspaloy

Weld Process

Hobart Dabber Welder System

Weld Current

400 DC

Amperage

100 Amp

Weld Preparation

Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas

Argon

Gas Flow Rate

35 CFH (991,5 L/h)

Trailing Gas

;

:

:

Gas Flow Rate

:

Voltage (AVC)

7.7

Deadband

4

Sensitivity

3

Lock Out

Νo

Retract Distance

0

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Repair No.9
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:

K.610-14-28 snec OVERHAUL

Starting Arc Gap

: .05

Start Delay

1.5

Welding Current

Fusion Mode

: Pendant Setting 32 Amps

Weld Mode

Pendant Setting 37 Amps

Filler Material Spec.

OMat 3/99

Size

. .030 in. (0,76 mm) dia.

Feed Rate

7.2 IPM (183 mm/min.)

Filler Wire Start Delay

1.3

Filler Wire Stop Delay

0.1

Dabber Strokes/Min

: 320

Stroke Length

: 0.470 in. (12 mm)

Pulsation

No

Weld Speed

Fusion Mode

50

Weld Mode

50 Increasing to 80 as Fin

Height Progresses

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

COMMENTS: Set table at 90°, wire brush after each weld

deposit.

B. Labyrinth Fin No.28 (Individual).

Material

: Waspaloy

Weld Process

Hobart Dabber Welder System

Weld Current

400 DC

Amperage

100 Amp

REPAIR 72-52-02 Repair No.9 Page 421 Jan 31/94

IK.610-14-28 snecm OVERHAUL

Weld Preparation

Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas

: Argon

Gas Flow Rate

: 35 CFH (991,5 L/h)

Trailing Gas

Gas Flow Rate

:

Voltage (AVC)

: 7.1

:

Deadband

4

Sensitivity

3

Lock Out

No

Retract Distance

0

Starting Arc Gap

: .05

Start Delay

1.5

Welding Current

Fusion Mode

: Pendant Setting 32 Amps

Weld Mode

Pendant Setting 35 Amps

Filler Material Spec.

: OMat 3/99

Size

: .030 in. (0,76 mm) dia.

Feed Rate

7.4 IPM (188 mm/min.)

Filler Wire Start Delay :

1.3

Filler Wire Stop Delay :

0.1

REPAIR

Jan 31/94

72-52-02 Repair No.9 Page 422



MK.610-14-28 snecma OVERHAUL

Dabber Strokes/Min

: 320

Stroke Length

: 0.470 in. (12 mm)

Pulsation

No

Weld Speed

Fusion Mode

60

Weld Mode

60 Increasing to 100 as Fin

Height Progresses

NOTE: All readings shown are machine dial readings unless

otherwise indicated.

COMMENTS: Set table at 900, wire brush after each weld

:

:

deposit.

C. Labyrinth Fin No.29 (Individual).

Material

: Waspaloy

Weld Process

: Hobart Dabber Welder System

Weld Current

: 400 DC

Amperage

: 100 Amp

Weld Preparation

Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas

: Argon

Gas Flow Rate

: 35 CFH (991,5 L/h)

Trailing Gas

:

Gas Flow Rate

Voltage (AVC)

: 7.7

52-02

REPAIR

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OVERHAUL

4 Deadband

3 Sensitivity

Lock Out No

Retract Distance

.05 Starting Arc Gap

Start Delay 1.5

Welding Current

Fusion Mode Pendant Setting 32 Amps

Weld Mode Pendant Setting 35 Amps

OMat 3/99 Filler Material Spec.

.030 in. (0,76 mm) dia. Size

7.4 IPM (188 mm/min.) Feed Rate

1.3 Filler Wire Start Delay

Filler Wire Stop Delay 0.1

Dabber Strokes/Min 320 :

0.470 in. (12 mm) Stroke Length

Pulsation Νo

Weld Speed

60 Fusion Mode

60 Increasing to 100 as Fin Weld Mode

Height Progresses

All readings shown are machine dial readings unless NOTE:

otherwise indicated.

Set table at 90°, wire brush after each weld COMMENTS:

deposit.

REPAIR Repair No.9 Page 424 Jan 31/94

K.610-14-28 snecm OVERHAUL

D. Labyrinth Fin No.30 (Blanket Weld).

Material

: Waspaloy

Weld Process

Hobart Dabber Welder System

Weld Current

400 DC

Amperage

: 100 Amp

Weld Preparation

Machined Surface, Degrease

using MEK. OMat 135

Electrode Specification

Material: 2% Thoriated

Tungsten

Size: 1/16 in. (1,6 mm) dia.

OMat 3/153

Shielding Gas

: Hy-plas

Gas Flow Rate

: 35 CFH (991,5 l/h)

Trailing Gas

:

Gas Flow Rate

Voltage (AVC)

8.2

Deadband

4

Sensitivity

: 3

Lock Out

No

Retract Distance

. 0

Starting Arc Gap

.05

Start Delay

2.7

Welding Current

Fusion Mode

: Pendant Setting 34 Amps

Weld Mode

: Pendant Setting 45 Amps

Filler Material Spec.

OMat 3/99

Size

.030 in. (0,76 mm) dia.

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REPAIR

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OVERHAUL

8.0 IPM (203 mm/min.) Feed Rate

Filler Wire Start Delay 2.3

Filler Wire Stop Delay 0.1

Dabber Strokes/Min 315

0.470 in. (12 mm) Stroke Length

Pulsation No

Weld Speed

Fusion Mode 60

60 Weld Mode

NOTE: All reading shown are machine dial readings unless

otherwise indicated.

Set table at 80°, wire brush after each weld COMMENTS:

deposit.



LP TURBINE BLADE ASSEMBLY - REPAIR BY BLENDING DAMAGE ON ROOT FRONT FACE AND UNDERSIDE OF SEAL FIN

MODIFICATION NO. 8941C

1. <u>Effectivity</u>

| I.P.C. | <u>Fig./Item</u> | <u>Part No.</u> |
|----------|------------------|-----------------|
| 72-52-02 | 1 230A | B.918510 |
| | 230B | B.927343 |

2. <u>Introduction</u>

A. General

- (1) This repair describes the procedure for removing damage from the blade root front face and underside of seal fin extension by blending and polishing.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.



B. Repair Limitations

- (1) Maximum blend dimensions (Ref. Fig. 401)
 - (a) Area A: 0.020 in. (0,51 mm) deep

0.050 in. (1,27 mm) wide 0.750 in. (19,05 mm) long.

(b) Area B: 0.025 in. (0,64 mm) deep

0.150 in. (3,81 mm) wide

full width of blade neck.

- (2) Maximum number of blends per blade:
 - (a) Area A: 1
 - (b) Area B: 2
- (3) For reapplication of repair the total blend depth must not exceed the maximum stated in paragraph (1).

3. <u>Instructions</u>

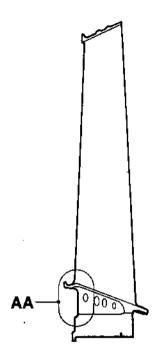
- A. Blend Damage
 - (1) Blend the damaged areas within the repair limitations using conventional hand tools. Blends must be smooth and continuous with no sharp edges (Ref. Fig. 401).
 - (2) Polish the blended areas to achieve a surface finish of 63 micro-inches (1,6 micro-metres).
- B. Inspect
 - (1) Visually inspect for the satisfactory removal of damage.
 - (2) Locally swab-etch the blended areas as instructed in Chapter 72-09-14 Repair, using Solution E. The etch solution must not encroach on the fir tree root.
 - (3) Crack test the blended areas using the fluorescent dye penetrant dye process specified for this component in Chapter 72-52-02 Inspection/Check.

C. Vapour Blast

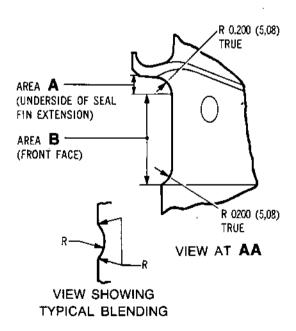
(1) Vapour blast the blended areas as specified in Chapter 72-09-13 Repair, using Procedure A.

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Repair No.10
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CR 36271/00A



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)



LP Turbine Blade Blending Details Figure 401

72-52-02 Repair No.10 Page 403 Jun 1/90



- D. Identify
 - (1) Mark SAL B.512676 or R10 adjacent to the existing part number, using vibro-percussion engraving as specified in Chapter 72-09-00 Repair.
- E. Final Inspection
 - (1) Finally inspect the blades to ensure that the repair has been carried out satisfactorily and that the blades are in a serviceable condition.
- 5. Special Tools, Fixtures and Equipment

None

6. <u>Replacement Parts</u>

None



BLADE, TURBINE L.P. ASSY OF REMOVE AND REPLACE DEFECTIVE BRIDGEPIECE B517886

1. EFFECTIVITY

IPC

Fiq./Item

Part No.

72-52-02

1 230B

B927343

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process shall be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This instruction gives the procedure to remove and replace defective Bridgepiece on the Blade, Turbine L.P. Assy of.

A test sample is required for validation purposes prior to the initial repair and any subsequent change of process, sub-contractor or locality. Details of the validation test requirements should be obtained by writing to the Repair Authority at Rolls-Royce plc.

Authorised Repair Vendors for this repair are:-

Machining process:-

Gaugemaster Co. Ltd., 93 Leopold Street, Birmingham, B12 DUD.

Brazing process:-

Bodycote Heat Treatments Ltd., 11 Bamfurlong Ind. Park, Staverton, Cheltenham, GL51 6SX.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 (0,1) to 0.020 (0,5)
Machine where marked
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

72-52-02 Repair No.11

> Page 401 Dec 30/98

REPAIR



4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- A. Machine to remove Bridgepiece (shroud top face).
- 1) Locate blade to a suitable fixture and align blade shroud. NOTE: Blade shroud to be in an upright position.

Use a grinding machine. Refer to Fig. 401, 402, 403, 404, 405, 406 and 407.

2) Grind to remove bridgepiece from shroud (top face) of blade. Refer to Fig. 401, 402, 403, 404, 405, 406 and 407.

NOTE: Minimum wall section at concave abutment slot edge 0.065 (1,65).

Minimum wall section at convex abutment slot edge 0.071 (1,80).

Remove a minimum amount of parent material to ensure all evidence of braze has been removed, maintaining dimensions shown in figures.

- B. Machine to remove Bridgepiece (shroud interlock faces).
- Locate blade to suitable fixture(s) and align blade shroud.

Use a grinding machine. Refer to Fig.401, 402, 403, 404 and 407.

2) Grind concave and convex shroud interlock abutment faces to remove remnants of bridgepiece.
NOTE: Ensure all evidence of braze has been removed, maintaining dimensions

Refer to Fig. 401, 402, 403, 404 and 407.

C. Remove any excess braze/burrs.

shown in figures.

 Remove burrs and sharp edges. Remove any braze remnants as required. Re-produce radii and chamfers shown in Fig. 408. Use hand held tools. Refer to Fig.401, 402, 407, 408 and 409.

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REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- D. Examine the Part.
- Dimensionally inspect for removal of defective bridgepiece.

Use standard inspection equipment. Refer to Fig. 401, 402, 403, 404, 405, 406, 407, 408 and 409.

- E. Etch the Repaired Area.
- 1) Do a swab etch of the repaired area.

NOTE: Thoroughly wash to ensure complete removal of etch solution from the cooling holes.

Refer to TASK 70-00-00-200-214. SUBTASK 70-00-00-110-214-A01. Refer to Fig. 406.

- F. Penetrant Crack Test.
- Do a penetrant crack test on the repair area.

Refer to TASK 70-00-00-200-210. SUBTASK 70-00-00-230-210-002. Use OMat 651 Fluorescent penetrant high sensitivity post-emulsified. Refer to Overhaul Manual Chapter 72-52-Q2 Inspection/ Check. Use penetrant crack test equipment.

- G. Vapour Degrease.
- Vapour degrease blade and new bridgepiece prior to brazing.

Refer to TASK 70-00-00-100-101 Use degreasing equipment. Use Item 1 B517888 Bridgepiece 1 off.



SUPPLEMENTARY INFORMATION

- H. Braze the Part.
- Vacuum braze bridgepiece to blade shroud.

NOTE: Stop off to to be applied to the cooling holes either side of the bridgepiece slot in the blade shroud, completely around braze joint area on the top surface of shroud and also to the complete lower surface of shroud. Stop off is to be applied to the cooling hole undercut in the bridgepiece. Remove stop off using a suitable brush.

Refer to TASK 70-00-00-300-416 SUBTASK 70-00-00-860-416-053. Use OMat 3/118A high temperature brazing filler powder. Foil, paste or tape may be used. Use OMat 3/122A stopping-off paint. Use vacuum/argon atmosphere furnace.

- J. Examine the Part.
- Visually inspect the brazed joint between the blade and the new bridgepiece.

Refer to Para.6. Data for Acceptance standard.

- K. Heat Treat the Part.
- Heat treat the part (Ageing heat treat).

Heat in vacuum or Argon to between 1090 to 1110 deg.C (1994 to 2030 Deg.F) for 1 hour. Use vacuum/argon atmosphere furnace.

2) Cool part.

Cool in vacuum/argon by rapid qas quench.

- L. Heat Treat the Part.
- Heat treat the part (Ageing heat treat).

Heat in vacuum or Argon to between 840 to 860 deg.C (1544 to 1580 Deg.F) for 2 hour. Use vacuum/argon atmosphere furnace.

Cool part.

Cool in vacuum/argon by rapid gas quench.

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REPAIR



SUPPLEMENTARY INFORMATION

- M. Penetrant Crack Test.
- Do a penetrant crack test on the part.

Refer to TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-001. Use OMat 651 fluorescent penetrant high sensitivity post-emulsified. Refer to Overhaul Manual Chapter 72-52-02 Inspection/ Check. Refer to Para.6 Data for Acceptance standard. Use penetrant crack test equipment.

- N. <u>Ultrasound Scan.</u>
- Utrasound scan the brazed joint between the blade and the new bridgepiece.

All blades to be returned to Rolls-Royce, Bristol, for the ultrasound scan process using Rolls-Royce process BR0113. Refer to Para.6 Data for acceptance standard.

- P. Machine the Part (shroud top face).
- 1) Locate blade to a suitable fixture and align blade shroud. NOTE: Blade shroud to be in an upright position.

Use a grinding machine. Refer to Fig.401, 405, 410, 411, 412 and 413.

2) Finish grind top face of bridgepiece to produce 11.968 (303,99)/11.963 (303,86) dimension to blade datum.

Refer to Fig. 401, 405, 410, 411, 412 and 413.

- Q. Machine the Part (shroud interlock faces).
- Locate blade to suitable fixture(s) and align blade shroud.

Use a grinding machine Refer to Fig. 401, 405, 410, 411 and 412.

2) Finish grind concave and convex shroud interlock faces to finished dimensions shown in the figures.
NOTE: 0.005 (0,13) maximum step permissible.

Refer to Fig. 401, 405, 410, 411 and 412.

REPAIR

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SUPPLEMENTARY INFORMATION

- R. Machine the Part (shroud corner radii).
- Locate blade to suitable fixture(s) and align Blade shroud.

Use a grinding machine. Refer to Fig. 401, 410 and 411.

2) Finish grind concave and convex 0.080 (2,03) corner radii to shroud interlock corners.
NOTE: 0.005 (0,13) maximum step permissible.

Refer to Fig. 401, 410 and 411.

- S. Machine the Part (Bridgepiece holes).
- Locate blade to a suitable fixture and align blade shroud.

Use a electro discharge machine. Refer to Fig. 401, 410, 412 and 414.

2) Electro discharge machine
3 off 0.115 (2,92)/0.120 (3,05),
0.140 (3,56)/0.145 (3,68) and
0.160 (4,06)/0.165 (4,19)
diameter holes in bridgepiece.
NOTE: Wall thickness between
any 2 holes must not be
less than 0.010 (0,25).

Refer to TASK 70-00-00-300-708. Refer to Fig. 401, 410, 412 and 414.

- T. Dress Bridgepiece/shroud.
- Dress underside of protruding bridgepiece edges at shroud interlock areas and radius shroud edges.
 Remove any other burrs and sharp edges.

Use hand held tools. Refer to Fig.412 and 413.

- U. Examine the Part.
- Do a dimensional inspection of the part.
 NOTE: Visually inspect cooling holes to ensure no blockage.

Use standard inspection equipment. Refer to Fig. 401, 405, 410, 411, 412, 413 and 414.

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SUPPLEMENTARY INFORMATION

- V. Penetrant Crack Test.
- Do a penetrant crack test on the repair area.

Refer to TASK 70-00-00-200-210 SUBTASK 70-00-00-230-210-002. Use OMat 651 fluorescent penetrant high sensitivity post-emulsified. Refer to Overhaul Manual Chapter 72-52-02 Inspection/ Check. Refer to Para.6 Data for Acceptance standard. Use penetrant crack test equipment.

- W. Shot Peen the Part.
- Mask the area not to be shot peened.

Refer to TASK 70-00-00-300-338 SUBTASK 70-00-00-380-338-002. Refer to Fig. 401.

Set up peening parameters.

Refer to TASK 70-00-00-300-338 SUBTASK 70-00-00-380-338-002. Set up the shot peening machine to achieve an ALMEN intensity of 10N to 15N and coverage of 200 percent. Use OMat 1/28 Metallic shot (cast steel). Use shot peening equipment. Refer to Fig. 401.

Shot peen the blade.

Shot peen using the above parameters. Refer to Fig. 401.

- X. Dry Abrasive Blast the Part.
- 1) Set up blasting parameters.

Refer to TASK 70-00-00-300-338 SUBTASK 70-00-00-380-338-001. Set up blasting machine to achieve an ALMEN intensity of 2N minimum and a coverage of 200 percent. Use OMat 146 abrasive medium. Use dry blasting equipment.

2) Dry blast the blade all over.

Dry blast using the above parameters.

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REPAIR



SUPPLEMENTARY INFORMATION

- Y. Probe Check Cooling Holes.
- Probe check the cooling holes.
 Ensure all holes are free from obstructions.
- Z. Flow Check Cooling Holes.
- 1) Flow check cooling holes.

Refer to Fig. 415.

- AA. Identify the Repair.
- 1) Mark on B517886 or R11 adjacent the part number.

Refer to Overhaul Manual Chapter 72-09-00 Repair. Use vibration peen equipment. Refer to Fig.401.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

BLADE, TURBINE L.P. ASSY OF

MSRR 7193

QHB

- 6. DATA
 - A. Visual and Ultrasound Scan Quality Acceptance Standard
 - (1) <u>Introduction</u>
 - (a) This standard covers the visual and ultrasounc scan inspection of the brazed joint between the blade and bridgepiece.
 - (b) Blades for flight engines must be acceptable to this standard.
 - (2) Visual Inspection (Refer to Figures 416 and 417).
 - (a) (racks not acceptable.
 - (b) Lack of braze not acceptable except in corner radii as in (3)(a)(iii).
 - (c) Stiffening bars lack of braze at position marked thus xxxxx up to 10% of each length acceptable.

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(3) <u>Ultrasound Scan - Acceptable Imperfections (Refer to Figures 416 and 417).</u>

(a) Abutment Faces.

- (i) Up to 2 off line defects in the short face, provided their total length does not exceed 0.030 (0,75) A.
- (ii) Line type defects in long face 1 off up to 0.060 (1,50) in length or 2 off up to 0.030 (0,75) in length provided they are a minimum of 0.100 (2,50) apart B.
- (iii) Lack of braze in the corner radius between faces A and B due to mismatch F and G.

(b) Flat Bridge Section.

- (i) The minimum requirement of this area is 90% full braze.
- (ii) The area C on either side of the cooling hole clearance channel may have lack of braze not exceeding 10% of the whole area of the bridgepiece joint face provided no such defect is within 0.080 (2,00) of the brazed face B shown marked thus ////.

(c) Stiffening Bars.

- (i) Lack of braze on the face and closed edges of the stiffening bars DD and EE provided it does not exceed 10% of each length marked thus xxxxx.
- (ii) Porosity or lack of braze in radii at xxxxx.

(4) Excess Braze Material (Refer to Figures 416 and 417).

- (a) Braze material in air escape passage H or on blade surfaces is not acceptable.
- (b) Braze on shroud upper surfaces adjacent the bridgepieve is acceptable provided it is not so extensive as to suggest a poorly controlled technique.

REPAIR

72-52-02 Repair No.11 Page 409 Dec 30/98 (c) Braze material in cooling holes is acceptable provided the blade complies with the flow requirements specified on Fig.415 for each cooling hole that is affected.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

B517888 BRIDGEPIECE 1 1

9. STANDARD EQUIPMENT

Degreasing equipment
Dry blasting equipment
Electro discharge machine
Grinding machine
Hand held tools
Penetrant crack test equipment
Shot peening equipment
Standard inspection equipment
Vacuum/Argon atmosphere furnace
Vibration peen equipment

10. CONSUMABLE MATERIAL

OMat 1/28 Metallic shot (cast steel)

OMat 146 Abrasive medium

OMat 3/118A High temperature brazing filler powder. Foil and

paste may be used.

OMat 3/122A Stopping-off paint

OMat 651 Fluorescent penetrant high sensitivity post-

emulsified

NOTE: 1. To identify the consumable materials refer to the Overhaul Materials Manual (OMat).

 Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual (TSD594-J).

11. EXPENDABLE PARTS

NONE.

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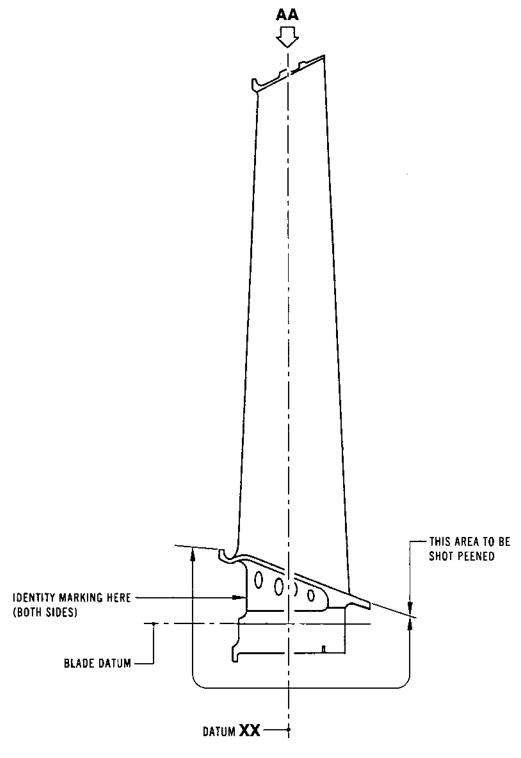
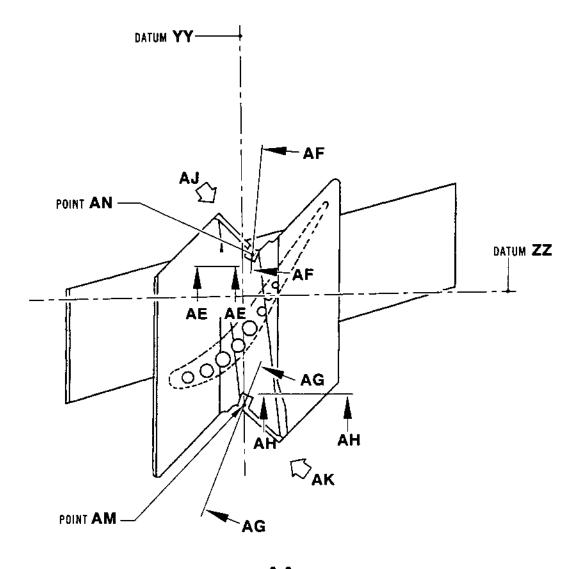


FIG.401

REPAIR

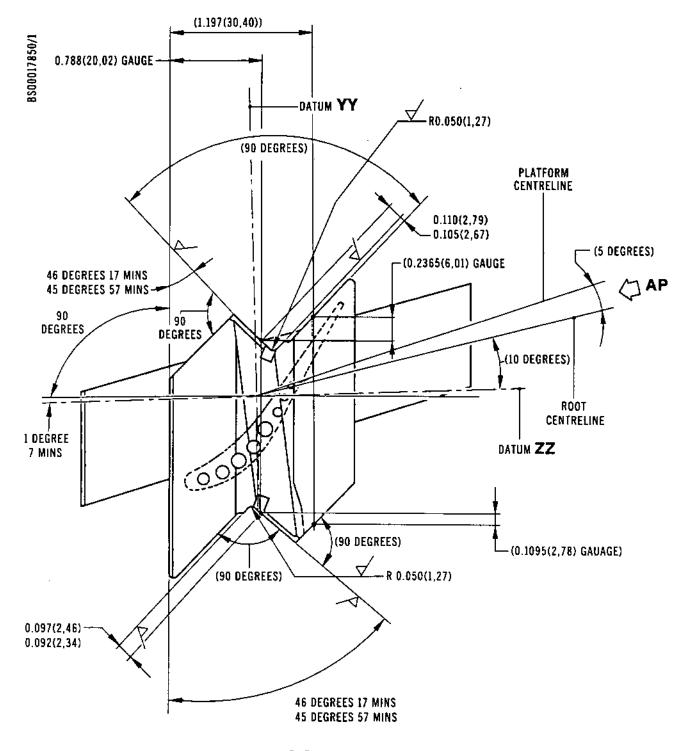
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VIEW AA





REPEAT VIEW AA

FIG.403



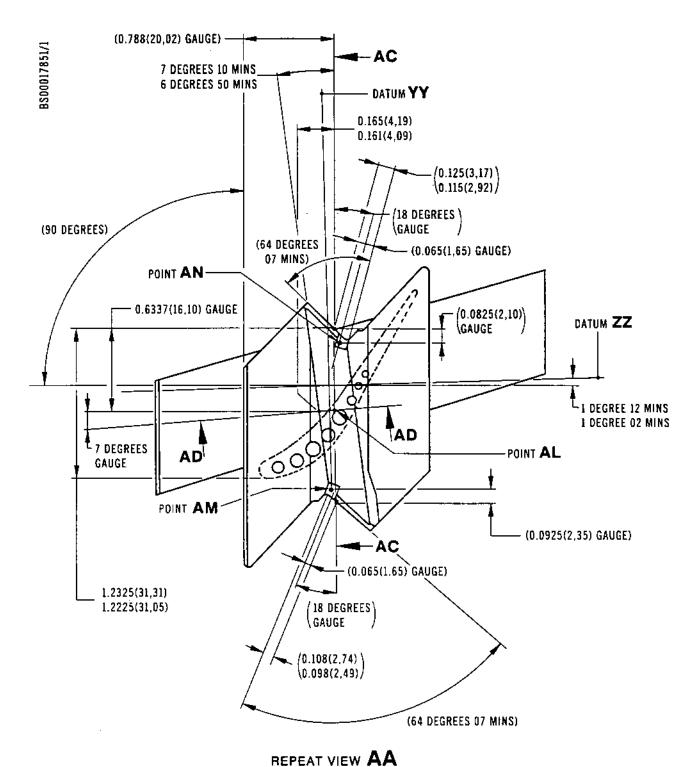
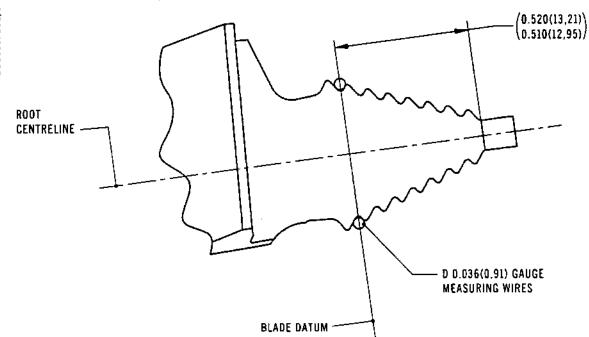


FIG.404



VIEW AP

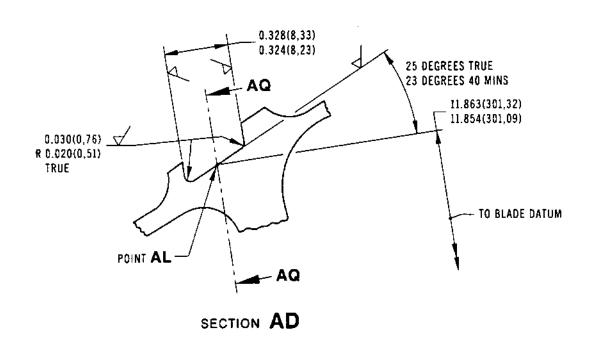
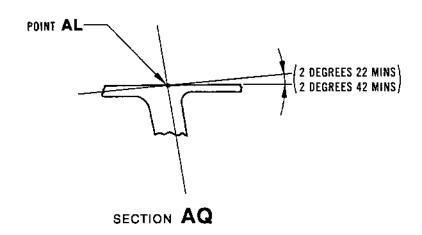
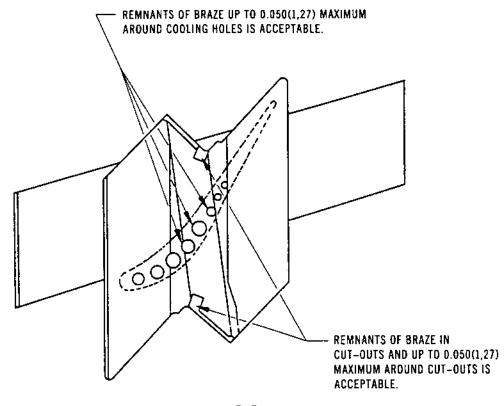


FIG.405

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BS00017853/1





REPEAT VIEW AA (SHOWING REMNANTS OF BRAZE)

FIG.406

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Printed in England

BS00017854/1

(0.065(1,65) MIN.)

1.415(35,94)
1.411(35,84)
90 DEGREES 45 MINS
90 DEGREES 25 MINS
(0.071(1.80) MIN.)

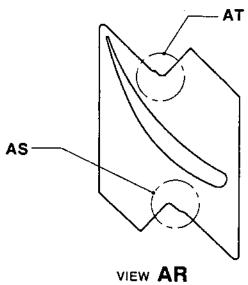
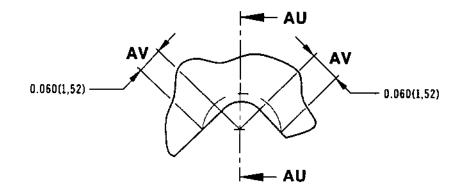


FIG.407

SECTION AC

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VIEW AS VIEW AT SIMILAR

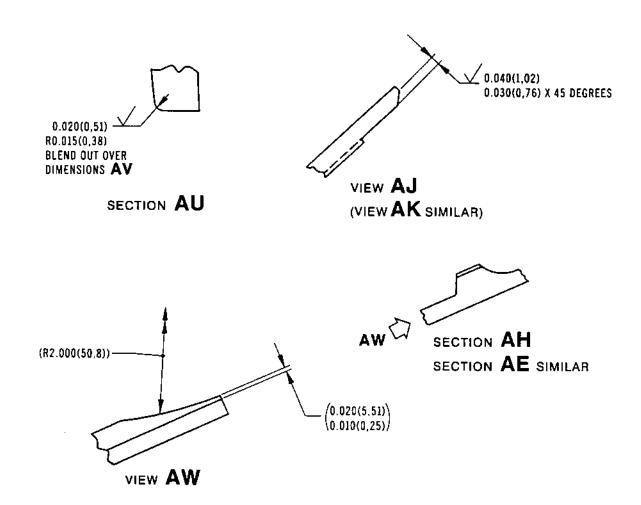


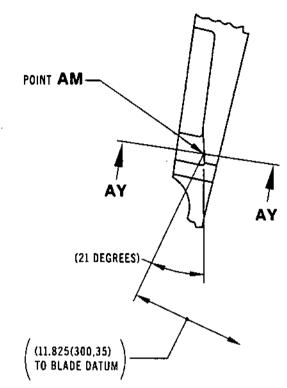
FIG.408

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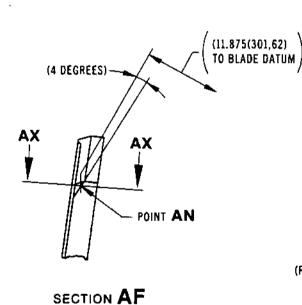
Printed in England

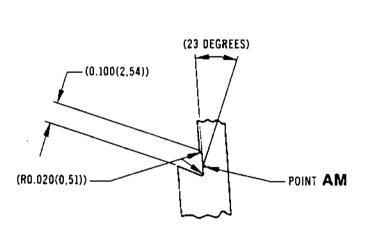
OVERHAUL

BS00017856/1 (23 DEGREES) (R 0.020(0,51)) -(0.100(2,54)) POINT AN SECTION AX



SECTION AG





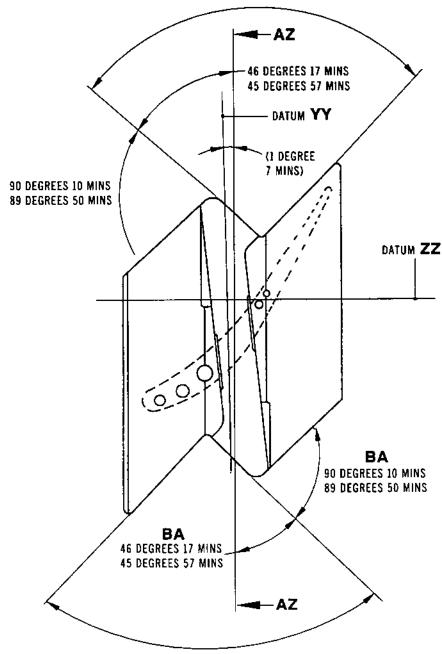
SECTION AY

FIG.409

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90 DEGREES 10 MINS 89 DEGREES 50 MINS



BA 90 DEGREES 10 MINS 89 DEGREES 50 MINS

DIMENSIONS BA APPLIES WHEN VIEWED IN DIRECTION OF ARROW BB

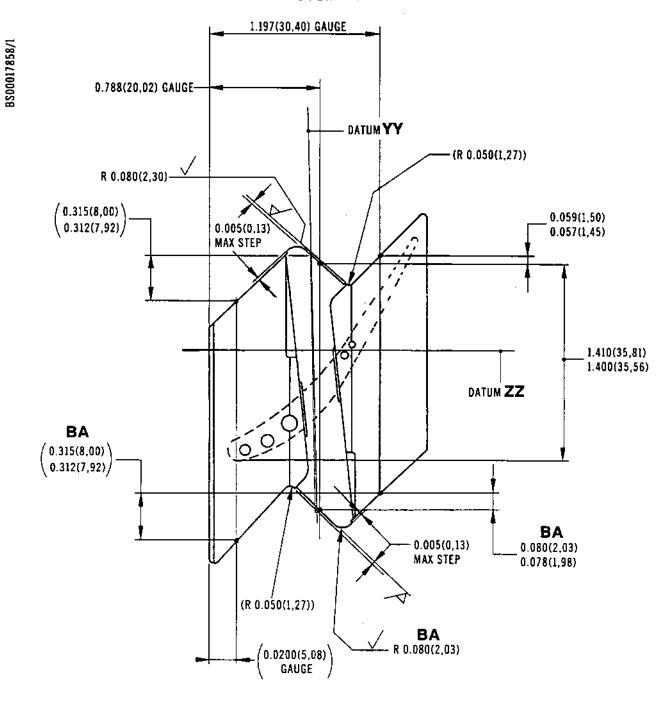
REPEAT VIEW AA

SHOWING FINISHED DIMENSIONS (BRIDGEPIECE BRAZED IN POSITION) (ROOT PLATFORM OMITTED) FIG. 410

REPAIR

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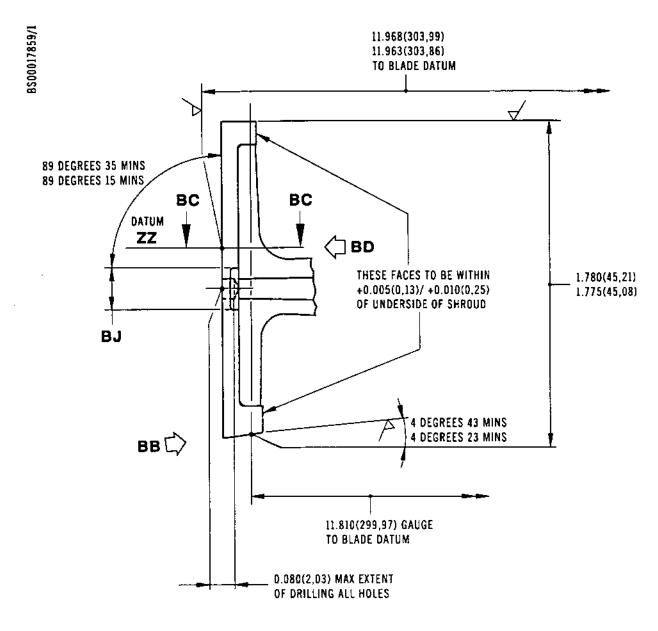


REPEAT VIEW AA SHOWING FINISHED DIMENSIONS
(BRIDGEPIECE BRAZED IN POSITION)
(ROOT PLATFORM OMITTED)

DIMENSIONS BA APPLIES WHEN VIEWED IN DIRECTION OF ARROW BB

FIG.411

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SECTION AZ

8200017860/1

0.070(1,78)

BG 0.050(1,27)

BF

0.070(1,78)

0.050(1,27) BF

0.050(1,27) BG

0.070(1,78)

VIEW BD

SHROUD EDGES TO BE RADIUSED

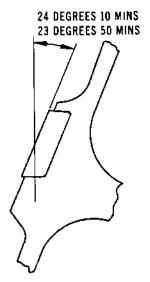
0.020(0.51)/0.030(0,76) OVER ARC

BE BLENDING OUT OVER LENGTH

BF AND BLENDING OVER LENGTH

BG TO 0.010(0,25)/0.020(0,51) OVER

LENGTH BH

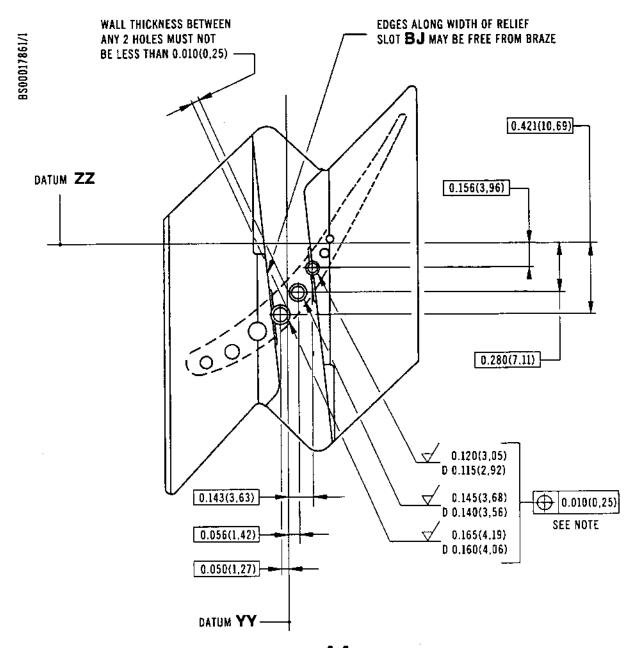


SECTION BC

FIG.413

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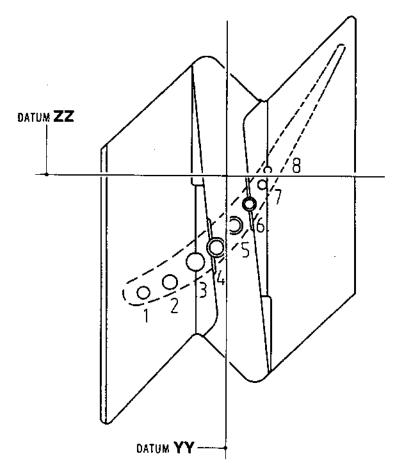




REPEAT VIEW AA SHOWING FINISHED
DIMENSIONS (BRIDGEPIECE BRAZED IN POSITION)
(ROOT PLATFORM OMITTED)

NOTE:- 3 HOLES THROUGH BRIDGEPIECE MAY BE PRODUCE BY ELECTRO-DISCHARGE MACHINING. COOLING HOLES TO BE FREE FROM BRAZE.

8500017862/1



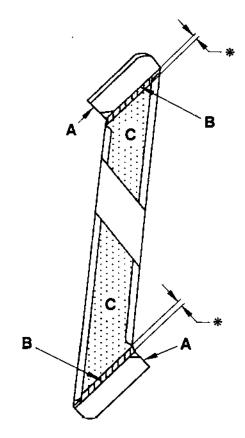
REPEAT VIEW **AA** SHOWING COOLING HOLE NUMBERS (ROOT PLATFORM OMITTED)

| HOLE NO. | MINIMUM FLOW RATE Ibs/sec | |
|----------|---------------------------|--------------------|
| 1 | 3.29 | <u> </u> |
| 2 | 7.02 | |
| 3 | 7.02 | |
| 4 | 6.02 | X 10 ⁻³ |
| 5 | 4.31 | 7 10 7 |
| 6 | 2.59 | |
| 7 | 1.57 | |
| 8 | 1.15 | |
| TOTAL | 32.97 | |

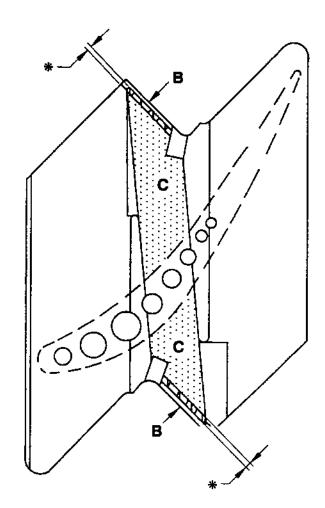
COOLING HOLES TO BE FLOW CHECKED TO FLOW RATE SHOWN. INLET PRESSURE 24.7 lbs/in ² ABSOLUTE. EXIT PRESSURE 14.7 lbs/in ² ABSOLUTE. TEMPERATURE 300° K HOLES MAY BE FLOW CHECKED SIMULTANEOUSLY

BS00017863/1

⊭ 0.080(2,00) (3.2b)



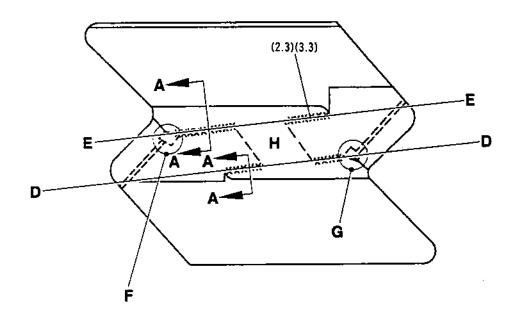
UNDERSIDE VIEW OF BRIDGEPIECE



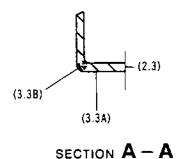
PLAN VIEW OF BLADE SHROUD

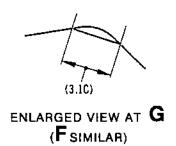
NOTE:- TO BE USED IN CONJUNCTION
WITH PARA. 6. (VISUAL AND ULTRASOUND
SCAN QUALITY ACCEPTANCE STANDARD)

BS00017864/1



PLAN VIEW OF BLADE AND BRIDGEPIECE ASSEMBLED





NOTE: TO BE USED IN CONJUNCTION WITH PARA. 6. (VISUAL AND ULTRASOUND SCAN QUALITY ACCEPTANCE STANDARD)



LP TURBINE BEARING SUPPORT - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|----------------------|------------|--|----------------|
| | 1 | Outer Labyrinth Housing Repaired by Application of Abradable Coating | SAL.B.478116-7 |
| SLAND | 2 | Bearing Housing Seal Lands Repaired by Application of Abradable Coating | SAL.B.478118-9 |
| IN EN | 3 | Repairing Damaged Insulation Blankets | SAL.B.488670 |
| PRINTED IN ENGLAND . | . 4 | CANCELLED (See Table of Approved Schemes) | |
| P | 5 | Sleeve Assembly Repair - Bores in Sleeve Repaired by Plasma Flame Spray | SAL.B.935547-8 |
| | 6 | Cover Assembly - Cracked Bosses Repaired by Welding | SAL.B.512675 |
| | | Socket Air Feed. Provision for Restoration of 1.751 (44,48)/1.750 (44,45) Bore by Chrome Plating | SAL.B.513976 |
| | . 8 | Socket Vent. Provision for Restoration of 1.751 (44,48)/ 1/750 (44,45) Bore by Chrome Plating | SAL.B.513669 |
| | 9 | Cover Assembly Rear. Provision for Replacement of Defective No.5 Oil Scavenge Tube | SAL.8.513489 |
| | 10 | Sleeve, Assy. of. Provision for replacement of defective air supply boss | SAL.B.514697 |
| | 11 | Socket, Air feed. Restoration of seal location bore by chromium plating | SAL.B.514743 |
| | 12 | Socket Vent. Restoration of seal location bore by plasma spray | SAL.B.514744 |

72-52-03

Contents 1

Jun 1/92

LP TURBINE BEARING SUPPORT - REPAIR OUTER LABYRINTH HOUSING REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Labyrinth Housing B.475046

Authority:

Modification No. OL.836OC

1. Introduction

- A. This Repair describes the procedure for restoring the outer labyrinth housing seal lands, in order to maintain the standard fin/housing clearances of labyrinth No.27 and No.28. Each defective location is first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETRES).

2. Repair Limitations

- A. One seal location, or both, may be restored at one repair.
- B. Verify that there is adequate material at defective locations to permit machining to the dimensions before spraying (Ref.para.3.B.).

3. Summary of Operations

- A. Set the labyrinth housing true on datum diameter A and flange face B (Ref.Fig. 401).
- B. Machine defective locations to the specified dimensions (Ref.Table 401 and Fig.402); a "witness" of grooves is acceptable after machining.
- C. Crack test the labyrinth housing with fluorescentpenetrant.

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Repair No.1

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- D. Apply Abradable Coating (Ref.Fig.403).
 - (1) Combustion spray the prepared seal land with a bond coating of Metco 450, 0.003 in./0.004 in. (0,076 mm/ 0,102 mm) in thickness.
 - (2) Plasma spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating 0.030 in. (0,762 mm) in thickness over the bond coating.
- E. Finish machine the seal lands (Ref. Table 401 and Fig. 401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Identify repair (Ref.Table 401). Mark the appropriate repair scheme number close to the standard part number on the labyrinth housing.

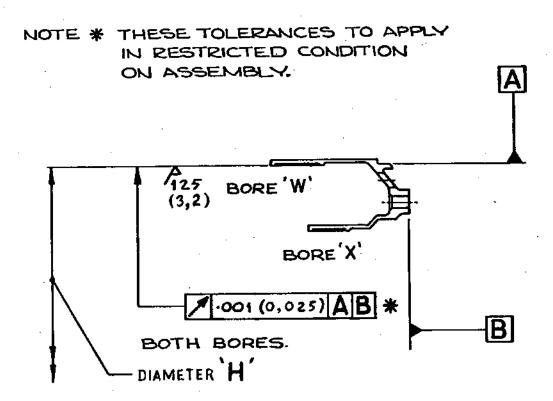
| REPAIR SCHEME NO. | BORE LOCATION (REF.FIG.401) | DIAMETER 'F' (REF.F | DIMENSION 'G' | DIAMETER 'H' (REF.FIG.401) |
|-------------------------|-----------------------------------|------------------------------------|--------------------------------|--------------------------------------|
| SAL B.478116 | 'W' | 11.243(285,572) 11.240(285,496) | 1.080(27,432) | 11.189 (284,201) 11.187 (284,150) |
| SAL B.478117 | 'X' | 8.518(216,357) 8.515(216,281) | 0.910(23,114) 0.900(22,860) | 8.464(214,986) 8.463(214,960) |

Before Spraying and Standard Dimensions
Table 401

REPAIR

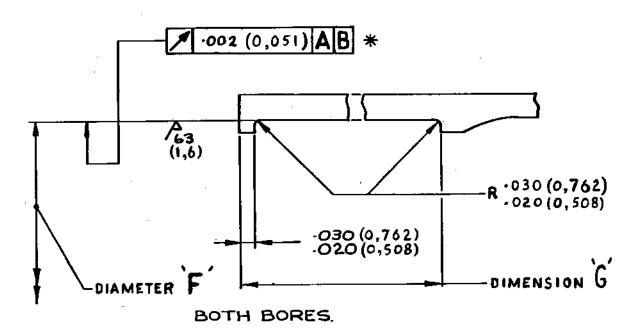
/2-52-03 Repair No.1 Page 402 Aug 1/75





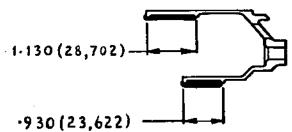
Standard Dimensions Figure 401





NOTE * THESE TOLERANCES TO APPLY
IN RESTRICTED CONDITION
ON ASSEMBLY.

Dimensions Before Spraying Figure 402



OVERSPRAY 15 PERMISSIBLE ON END FACES ONLY, AND MUST NOT EXTEND BEYOND DIMENSIONS SHOWN. ALL OVERSPRAY IS TO BE REMOVED.

Spraying Detail Figure 403

72-52-03 Repair No.1 Page 404 Aug 1/75



LP TURBINE BEARING SUPPORT - REPAIR BEARING HOUSING SEAL LANDS REPAIRED BY APPLICATION OF ABRADABLE COATING

Applicable to:

Housings B.485082, B.485083,

B.485084, B.485085,

B.485088, B.485089,

B.485094, B.485095

Authority:

Modification No. OL.8360C

1. Introduction

- A. This Repair describes the procedure for restoring the lp turbine bearing housing seal lands, in order to maintain the standard fin/housing clearances of labyrinth No.29 and No.30. Each defective location is first built up with an abradable coating then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, REPAIR for all standard practices, tolerancing and the spraying processes applicable to this repair procedure.
- C. Dimensions are shown thus in Table 401 and on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. One seal location, or both, may be restored at one repair.
- B. Verify that there is adequate material at each defective location to permit machining to the dimensions before spraying (Ref.para.3.B.).

3. Summary of Operations

- A. Secure the bearing housing to the centre-lathe faceplate and set true on datum bore A (Ref.Fig. 401).
- B. Machine defective locations to the specified dimensions (Ref. Table 401 and Fig. 402).
- C. Crack test the housing with fluorescent-penetrant.

REPAIR

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- D. Apply abradable coating:
 - (1) Combustion flame spray the prepared seal lands with a bond coating of Metco 450NS, 0.003 in./0.004 in. (0,076 mm/0,102 mm) in thickness.
 - (2) Flame spray Sherritt-Gordon 75/25 Nickel/Graphite abradable coating or Metco 313NS 0.030 in. (0,762 mm) in thickness over the bond coating.
- E. Set the housing true (Ref.para.A) and finish machine the seal lands (Ref. Table 401 and Fig.401).
- F. Visually inspect the repair for integrity of the sprayed coating and continuity of sprayed edges.
- G. Mark the coating identification symbols, Sherritt-Gordon

 HA and NG or Metco HA and GA as applicable, using
 the electro-chemical or vibro-percussion marking technique
 detailed in 72-09-00 Repair.
- H. Identify repair (Ref. Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the bearing housing.

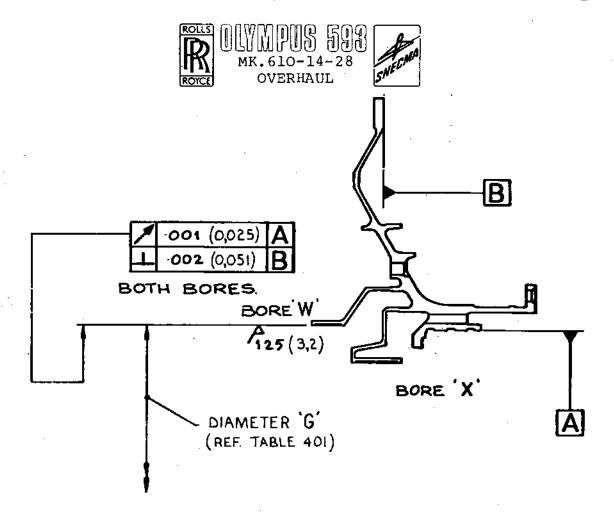
| REPAIR SCHEME NO. | BORE LOCATION (REF.FIG.401) | DIAMETER 'F' (REF.FIG.402) | DIAMETER 'G' (REF.FIG.401) |
|-------------------------|-----------------------------------|------------------------------------|------------------------------------|
| SAL B.478118 | W | 7.l53 (181,686) 7.l50 (181,610) | |
| SAL B.478119 | x | 5.573 (141,554) 5.570 (141,478) | 5.521 (140,233) 5.520 (140,208) |

Before Spraying and Standard Dimensions Table 401

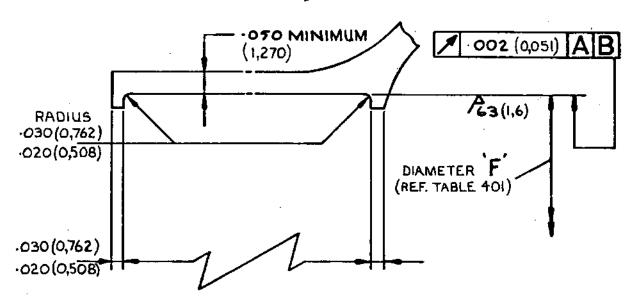
- 4. Special Tools, Fixtures and Equipment
 - A. Not required.
- Replacement Parts
 - A. Not required.

REPAIR

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Standard Dimensions Figure 401



BOTH BORES SIMILAR.

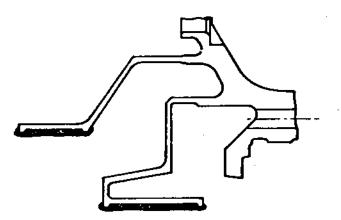
Machining Dimensions Before Spraying Figure 402

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OVERSPRAY PERMITTED ON END FACES ONLY. THIS IS TO BE REMOVED.

Spraying Detail Figure 403

m14764

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LP TURBINE BEARING SUPPORT - REPAIR REPAIRING DAMAGED INSULATION BLANKETS

Applicable to:

Insulation Blankets B.487920, B.487921, B.488313, B.488314, B.487926, B.484855 B.487922, B.487923, B.488315, B.488316

Authority:

Modification No. 0L.84230

1. Introduction

- A. This Repair describes the procedure for repairing insulation blankets which are cracked, torn or damaged by fretting.
- B. Refer to 72-09-00 Repair for all standard practices and tolerancing applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETRES).

2. Summary of Operations

- A. General Repair Procedure.
 - (1) Before patching, replace any lost packing with insulating material to a density of 6 lb/cu ft. (96,12 kg/cu metre) and 0.500 in. (12,70 mm) in thickness.
 - (2) Use a portable resistance welding kit for all patching repairs.
 - CAUTION: DO NOT OBSTRUCT BREATHERS WHEN APPLYING PATCHES.
 - (3) Prepare mating faces for welding by wire brushing and swabbing with Genklene.

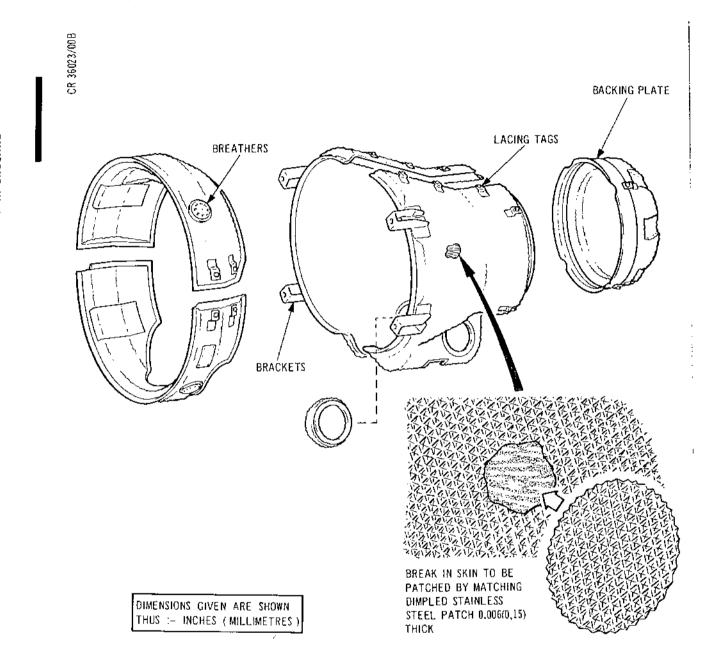


- (4) Weld all patches as near as possible to their edges.
- B. Repairs to Outer Skin.
 - (1) Cracks and fretting; repair by patching.
 - (2) Tears; remove damaged area, radius corners 0.250 in. (6,350 mm) and apply patch.
 - (3) Produce patches from matching dimpled sheet large enough to ensure a minimum overlap of 0.500 in. (12,70 mm) on existing skins.
 - (4) When fitting each patch, ensure that the dimples on blanket and patch engage each other.
 - (5) When defects are within 1.000 in. (25,400 mm) of each other, cover with a single patch to avoid the need for adjacent patches.
 - (6) When the number of defects necessitates a patch in excess of 2 sq. in. (2580,64 sq. mm) remove the defective area of skin before patching.
 - (7) The length of any one side of a patch must not exceed 4.000 in. (101,600 mm).
 - (8) When defects occur adjacent to previously patched repairs, remove the existing patches and skin so that, where possible, one larger patch will cover the maximum amount of damage.
- C. Repairs to End 'Z' Section.
 - Bent edge; straighten out.
 - (2) Cracks in edge; patch using standard end 'Z' section.
 - (3) Tears; remove damaged area, radius corners 0.250 in. (6,350 mm) and apply patch.
 - (4) Produce patches large enough to ensure a minimum overlap of 0.500 in. (12,70 mm) on existing skins.
 - (5) Produce end 'Z' section patch large enough to overlap existing material by 0.250 in. (6,350 mm).



- D. Repairs to Half Aperture.
 - (1) Bent edge; straighten out.
 - (2) Cracks, tears and rents; remove damaged area and patch as described for outer skin. Each patch must surround the damage.
 - (3) Repair the half aperture as described for end 'Z' section.
- E. Repair Backing Plate, Lacing Tags and Brackets.
 - Carefully remove defective parts.
 - (2) Draw from stores the necessary standard replacement parts.
 - (3) Weld replacement parts to insulating blanket.
- F. Inspect Repairs.
 - (1) Inspect the insulating blanket to ensure that all repairs have been satisfactorily completed.
- G. Identify repair. Mark the repair scheme number SAL B.488670 close to the standard part number on the insulating blanket.
- 3. Special Tools, Fixtures and Equipment
 - A. Not required.
- 4. Replacement Parts

| <u>Description</u> | Quantity | Part No. |
|---------------------|----------|---|
| Backing Plate | As req'd | BP1 (DARCHEM AERO LTD.) |
| Lacing Tag | As req'd | LT1 OR LT2 (DARCHEM |
| Insulating Material | As req'd | AERO LTD.) B2 (DARCHEM AERO LTD.) |



Repairing Damaged Insulation Blankets Figure 401

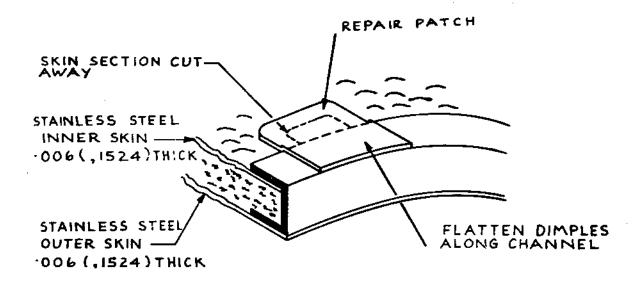
72-52-03

Repair No.3

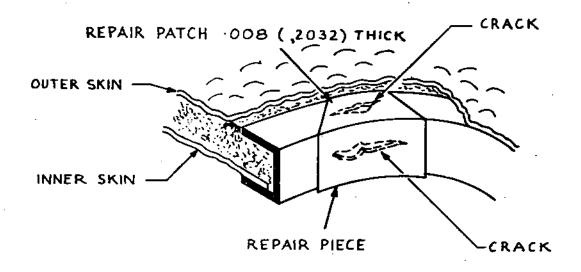
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DAMAGE TO INNER SKIN (ADJACENT TO THE FRAMEWORK) (SIMILAR REPAIR FOR OUTER BLANKET SKIN)



SPLIT CHANNEL (CIRCUMFERENTIAL AND RADIAL CRACK)

Repairing Damaged Insulation Blankets Figure 402

REPAIR

72-52-03

Repair No.3

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SLEEVE ASSEMBLY REPAIR BORES IN SLEEVE REPAIRED BY PLASMA FLAME SPRAY

MODIFICATION NO.8847

1. Effectivity

<u>IPC</u> <u>Fig./Item</u> <u>Part No.</u> 72-52-03 2 130 B.440050

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the bores of the sleeve assembly by machining the damaged bores, building up by plasma spray, and machining to the original dimensions.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.



- B. Repair Limitations.
 - (1) Either or both bores may be restored using this repair process (Ref. NOTE in front of paragraph B of Instructions).

3. Instructions

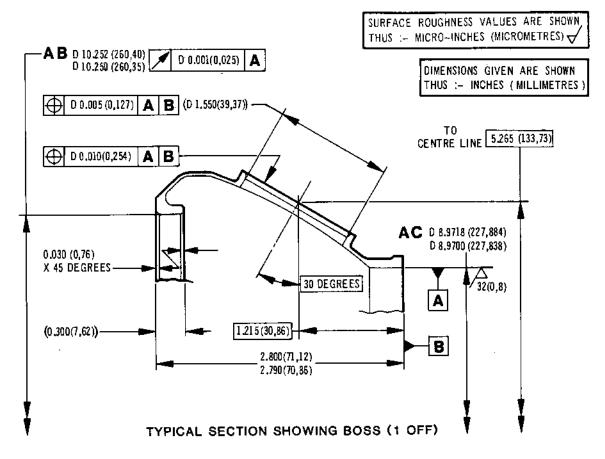
- A. Inspect.
 - (1) Inspect to determine which bores are to be repaired.

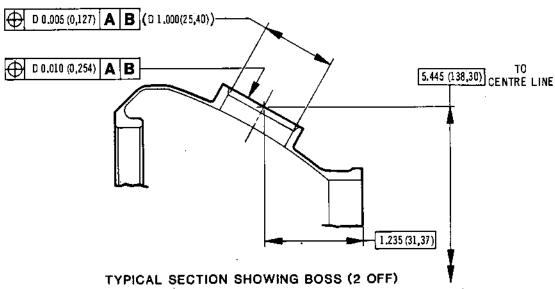
 Mark as necessary using temporary marking (Ref.72-09-00 Inspection/Check).

NOTE: The repair procedure from paragraph B onwards can be applied to either the front or the rear bore. If both bores are to be restored, carry out the complete procedure from paragraph B onwards for the rear bore, then repeat the procedure from paragraph B onwards for the front bore.

- B. Remove Distortion.
 - (1) Remove distortion, if necessary, using conventional methods until the bores are true relative to the bosses (Ref. Fig. 401).
 - (2) Inspect to ensure the satisfactory completion of the previous operation.
- C. Machine.
 - (1) Locate the small end diameter in a four-jaw chuck on a lathe, and set true to the bore to be machined.
 - (2) Machine the bore to the dimensions given in Figure 402.
 - (3) Remove burrs and sharp edges.
- D. Inspect.
 - (1) Inspect to ensure the satisfactory completion of the previous operation.
 - (2) Crack test the sleeve assembly using the fluorescent dye penetrant process specified for this component (Ref.72-52-03 Inspection/Check).





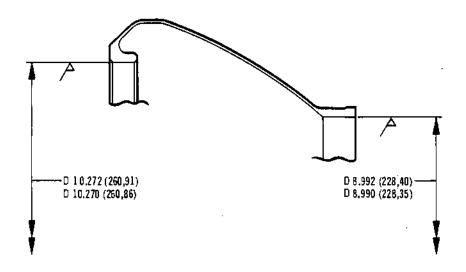


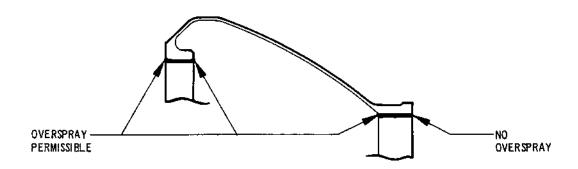
Finish Dimensions Figure 401

REPAIR 72-52-03 Repair No.5 Page 403 Mar 1/84



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)





Machining and Plasma Spray Details Figure 402

72-52-03

Repair No.5

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E. Plasma Spray.

- (1) Plasma spray the machined bore to a sufficient depth of deposit to allow for machining to finish dimensions. Refer to 72-09-11 Repair for plasma spray procedure, and use MSRR 9507/5 spray medium.
- (2) Inspect to ensure the satisfactory completion of the previous operation.

F. Machine.

- (1) Locate the small end diameter in a four-jaw chuck on a lathe, and set true to the bore not plasma sprayed.
- (2) Machine the plasma sprayed bore to the dimensions given in Figure 401.
- (3) Remove burrs and sharp edges.

G. Inspect.

- (1) Inspect to ensure the satisfactory completion of the previous operation.
- (2) Crack test the sleeve assembly using the fluorescent dye penetrant process specified for this component (Ref.72-52-03 Inspection/Check).

H. Identify.

(1) Mark SAL. B.935547 if the front bore has been restored, and SAL. B.935548 if the rear bore has been restored. Use electro-chemical marking or acid etching (Ref.72-09-00 Repair), and mark adjacent to the existing part number.

J. Inspect.

(1) Finally inspect to ensure that the repair has been carried out satisfactorily and that the sleeve assembly is in a serviceable condition.

4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.

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COVER ASSEMBLY - REPAIR CRACKING IN THE FLANGED BOSSES REPAIRED BY WELDING

MODIFICATION NO. OL.8941C

1. Effectivity

<u>I.P.C.</u> <u>Fig./Item</u> <u>Part No.</u> 72-52-03 2 110 B458072

2. Introduction

A. General.

- (1) This repair describes the procedure for repair of cracking in the flanged bosses by welding.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

- B. Repair Limitations.
 - (1) The maximum length of crack which may be repaired is 2.50 in. (63,5 mm).
 - (2) Multiple cracks may be repaired provided that the total combined length of cracking on each boss does not exceed 2.50 in. (63,5 mm).

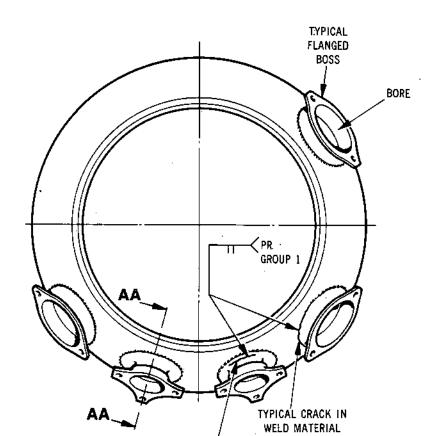
3. Instructions

- A. Remove Shank Nuts.
 - (1) Remove the self locking shank nuts as instructed in Chapter 72-09-00 Repair, taking care not to damage the holes.
- B. Locate Cracks.
 - Locate and groove out all visible cracks for identification purposes.
- C. Inspect.
 - (1) Inspect for cracks using the fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check, using process F1A, to ensure that all cracks have been located.
- D. Weld.
 - (1) Weld the cracks using TIG welding as instructed in TSD 594 OP 409, using filler wire MSRR 9500/3.
- E. Heat Treat.
 - (1) Heat treat in a vacuum furnace at 1050 deg.C plus/ minus 10 deg.C for a minimum of 5 minutes. Rapid gas quench.
- F. Inspect.
 - (1) Inspect for cracks using the fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check using process F1A.
 - (2) Inspect the weld repair using X-ray techniques as instructed in TSD 594 OP 409. Weld group classification and basic inspection weld group 1.

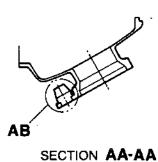
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TYPICAL CRACK IN PARENT MATERIAL





DETAIL AT **AB**TYPICAL 12 POSITIONS

Cover Assembly Welding Figure 401

72-52-03 Repair No.6 Page 403 Jun 1/90

- G. Dress Flush.
 - (1) Dress the welds flush in the bores of the bosses (Ref_Fig.401). Parent metal must not be impaired.
- H. Inspect.
 - (1) Inspect for cracks using the fluorescent dye penetrant process specified in Chapter 72-09-00 Inspection/Check, using process F1A.
- J. Replace Shank Nuts.
 - (1) Replace the shank nuts AS27857 as instructed in Chapter 72-09-00 Repair (Ref.Fig.401).
- K. Identify.
 - (1) Mark SAL B512675 or R6 adjacent to the existing part number using vibro-percussion marking as instructed in Chapter 72-09-00 Repair.
- L. Final Inspection.
 - (1) Finally inspect to ensure that the repair has been carried out satisfactorily, and that the cover is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

| <u>Description</u> | Qty. | Part No. | IPC Fig. Item |
|--------------------------|------|----------|----------------|
| Nut, self-locking, shank | 12 | AS27857 | 72-52-03/2-120 |



SOCKET AIR FEED

PROVISION FOR RESTORATION OF 1.751(44,48)/1.750(44,45) BORE BY CHROME PLATING

REPAIR NO. B513976

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-52-03

02 020A

B435150

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Maximum repairable diameter of socket vent bore is 1.781(45,24) (Refer Fig.1 sheet 4).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Locate component on a grinding machine and set true to Datum A. Grind bore to remove damage marks within dimensions shown. Remove a minimum amount of material to permit successive repairs. Refer fig.401

2) Dimensionally inspect.

Refer fig. 401

72-52-03 Repair No.7 Page 401 Dec 1/91 3) Crack Detect repaired area.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check.

4) Chrome Plate bore at location AB to a sufficient thickness to achieve final machined diameter. Plating must not be deposited within the 0.120(3,05) dimension.

Refer fig.402 Refer Overhaul Manual Chapter 72-09-07 Repair.

Visually inspect coating for defects. Refer Overhaul Manual Chapter 72-09-07 Repair.

6) Locate component on a grinding machine and set true to Datum A. Grind bore to post plating diameter. Refer fig.403

7) Dimensionally Inspect.

Refer fig.403

8) Visually Inspect coating for defects. Edges of coating to be smooth and continuous.

Refer Overhaul Manual Chapter 72-09-07 Repair.

9) Mark on SAL B513976 or R7 adjacent to existing part number using the vibro percussion engraving. Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

SOCKET AIR FEED

BSEM 699

HAYNES STELLITE 25

6. DATA

None.

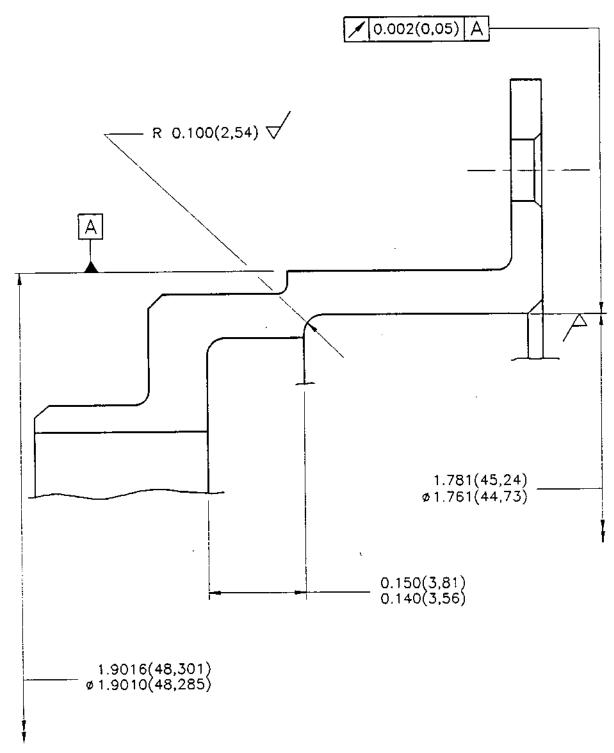
7. TOOLS

None.

8. REPLACEMENT PARTS

NONE.

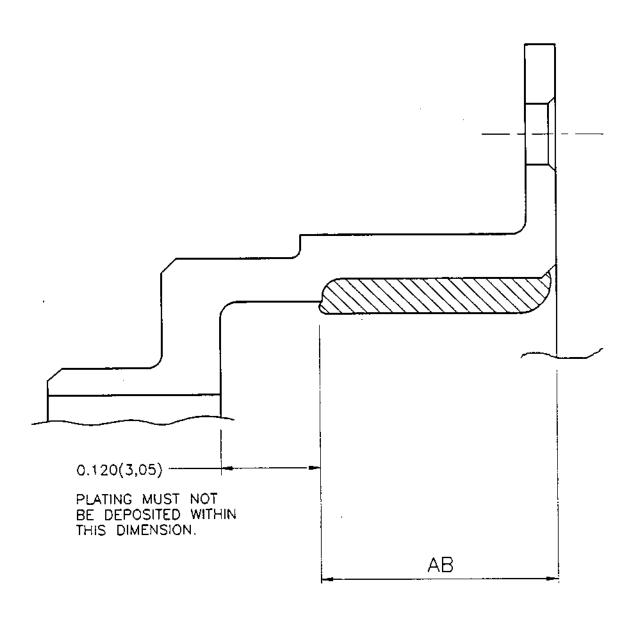
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SECTION SHOWING PRE-PLATING MACHINING FIG.401

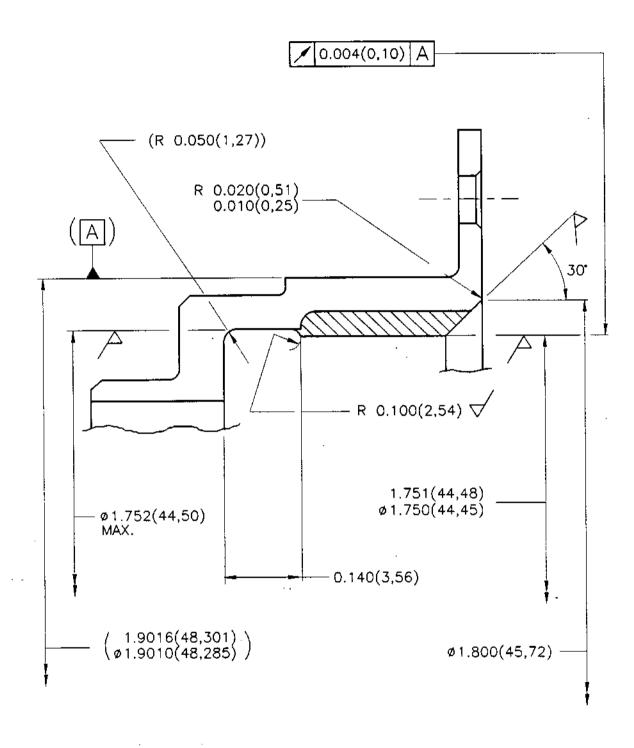
72-52-03 Repair No.7 Page 403 Dec 1/91





SECTION SHOWING AREA TO BE PLATED FIG.402

72-52-03 Repair No.7 Page 404 Dec 1/91



SECTION SHOWING FINAL MACHINING FIG. 403

72-52-03 Repair No.7 Page 405 Dec 1/91



SOCKET VENT

PROVISION FOR RESTORATION OF 1.751(44,48)/1.750(44,45) BORE BY CHROME PLATING

REPAIR NO. B513669

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-52-03

02 190A

B445406

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Maximum repairable diameter of socket vent bore is 1.781(45,24) (Refer Fig. 401).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Locate component on a grinding machine and set true to Datum A. Grind bore to remove damage marks within dimensions shown. Remove a minimum amount of material to permit successive repairs.
- 2) Dimensionally inspect.

Refer fig.401

Refer fig.401

72-52-03

Repair No.8

Page 401

Dec 1/91



3) Crack Detect repaired area.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Repair.

4) Chrome Plate bore at location AB to a sufficient thickness to achieve final machined diameter. Plating must not be deposited within the 0.180(4,57) dimension.

Refer fig. 402 Refer Overhaul Manual Chapter 72-09-07 Repair.

5) Visually inspect coating for defects.

Refer Overhaul Manual Chapter 72-09-07 Repair.

6) Locate component on a grinding machine and set true to Datum A. Grind bore to post plating diameter. Refer fig. 403

7) Dimensionally Inspect.

Refer fig.403

8) Visually Inspect coating for defects. Edges of coating to be smooth and continuous. Refer Overhaul Manual Chapter 72-09-07 Repair.

9) Mark on SAL B513669 or R8 adjacent to existing part number using the vibro percussion engraving. Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

SOCKET VENT

BSEM 699 HAYNES STELLITE 25

6. DATA

None

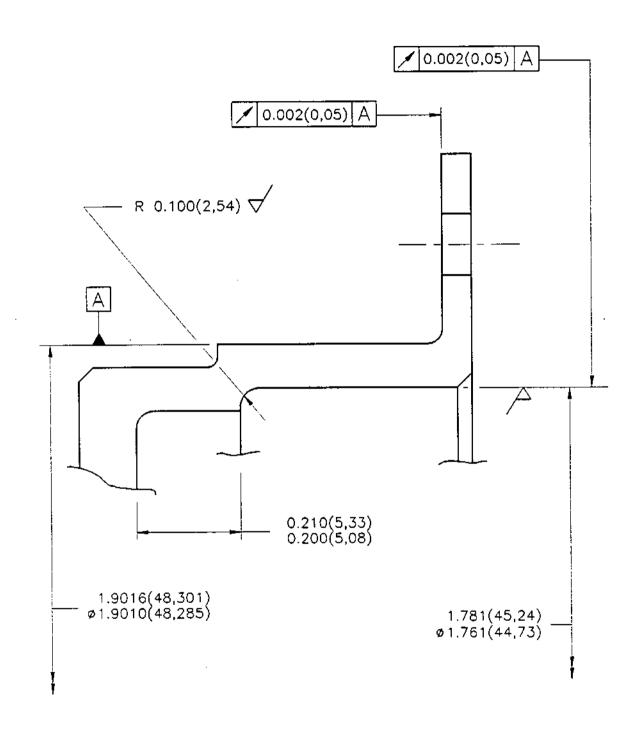
7. TOOLS

None

8. REPLACEMENT PARTS

NONE

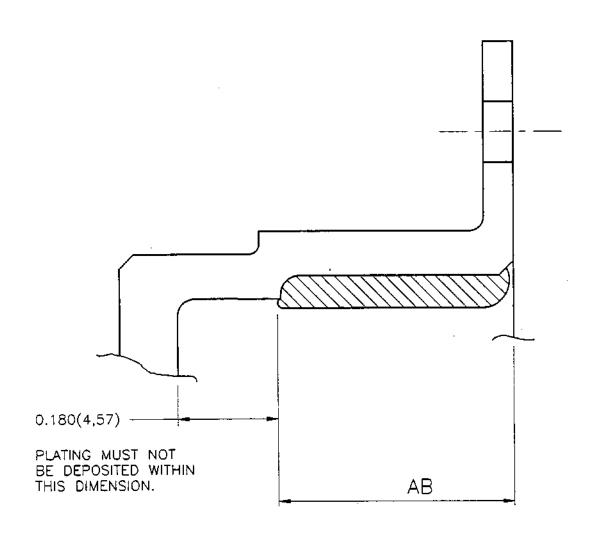
72-52-03
Repair No.8
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SECTION SHOWING PRE-PLATING MACHINING FIG. 401

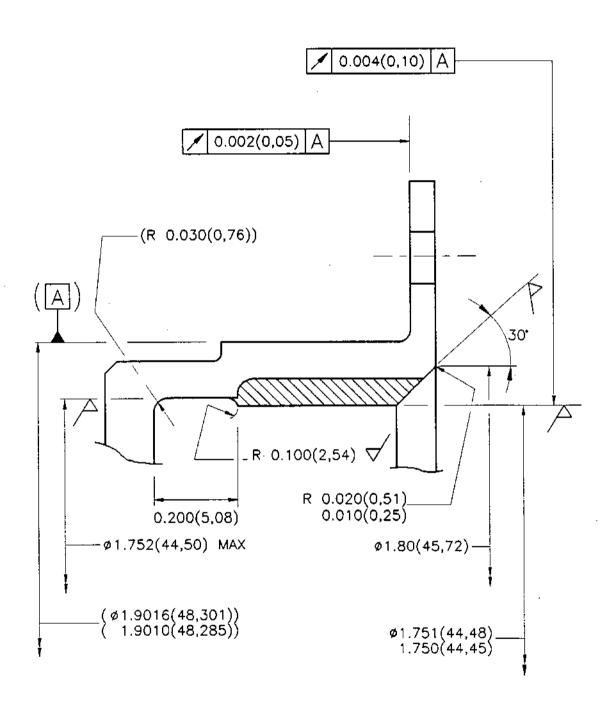
72-52-03 Repair No.8 Page 403 Dec 1/91





SECTION SHOWING AREA TO BE PLATED FIG.402

REPAIR 72-52-03 Repair No.8 Page 404 Dec 1/91



SECTION SHOWING FINAL MACHINING FIG.403

72-52-03 Repair No.8 Page 405 Dec 1/91



COVER ASSEMBLY-REAR

PROVISION FOR REPLACEMENT OF DEFECTIVE NO.5 OIL SCAVENGE TUBE REPAIR NO. B513489

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-52-03

160A ດ1

B474829

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

This repair may be embodied any number of times.

GENERAL 3.

UNLESS OTHERWISE SPECIFIED Drawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimeters) Tolerances on machined dimensions plus/minus .010 (0,25) Tolerance on angles plus/minus 2 degrees Break sharp edges .004 to .020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 125 (3,2) Microinches (Micrometers) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

REPAIR PROCEDURE 4.

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

Remove all 12 self locking shank nuts item 1.

Refer fig 401 Refer Para 8 REPLACEMENT PARTS. Refer Overhaul Manual Chapter 72-09-00 Repair.

Part off ferrule item 4. Union nut Refer fig 402 2) item 3 may be retained for re-use.

REPAIR Page 401 Dec 1/91



| 3) | Remove drain boss | item 2 by cutting | Refer | fig | 402 |
|----|-------------------------------------|-------------------------------------|-------|-----|-----|
| | on the waste side location diameter | and restoring the 1.255 (31,88)/ | | | |
| | 1.250 (31,75). | • | | | |

4) Locally true up repair location to Reference point AB dimension as required.

Refer fig 402

5) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check.

6) Assemble and argon arc weld drain boss item 2 in position. Refer fig 402
Refer Para 8 REPLACEMENT
PARTS.
Refer TSD 594 OP 409.
Using filler rod
MSRR 9500/16 (C263).
Group 1 weld.

7) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check.

X-ray inspect repaired area.

Refer TSD 594 OP 409.

9) Assemble ferrule item 4 and union nut item 3 and argon arc weld in position. Refer fig 402 Refer Para 8 REPLACEMENT PARTS. Refer TSD 594 OP 409. Using filler rod MSRR 9500/16 (C263) if required. Group 1 weld.

10) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check.

11) X-ray inspect repaired area.

Refer TSD 594 OP 409.

- 12) Heat treat component for 8 hours at 800°C \pm 10°C . Air cool.
- 13) Crack detect all over.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check.

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14) Replace 12 off self locking shank nuts item 1.

Refer fig 401 Refer Para 8 REPLACEMENT PARTS. Refer Overhaul Manual Chapter 72-09-00 Repair.

15) Mark on SAL B513489 or R9 adjacent to existing part number, using vibro-engraving method.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT MATERIAL RR CODE

COVER ASSEMBLY (C263)

REAR. (MSRR 7035 QAH

(MSRR 7036 QAR

6. DATA

NONE

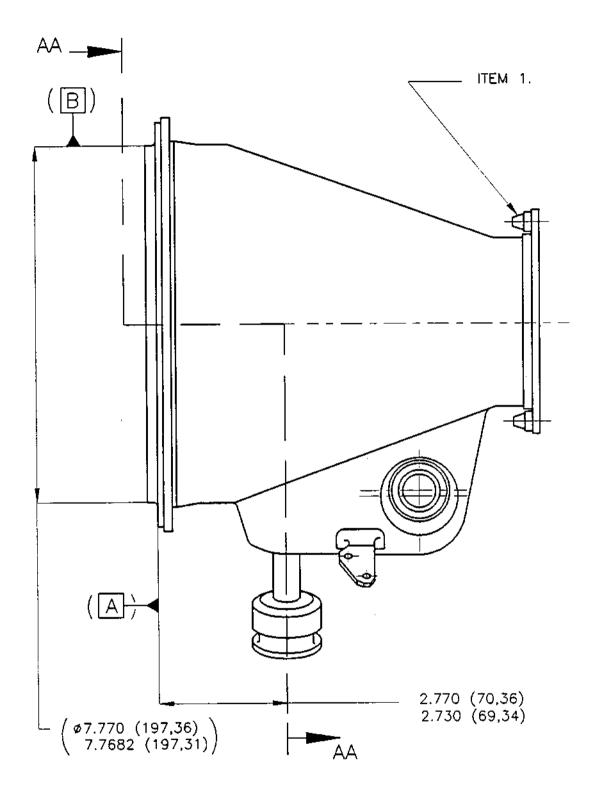
7. TOOLS

NONE

8. REPLACEMENT PARTS

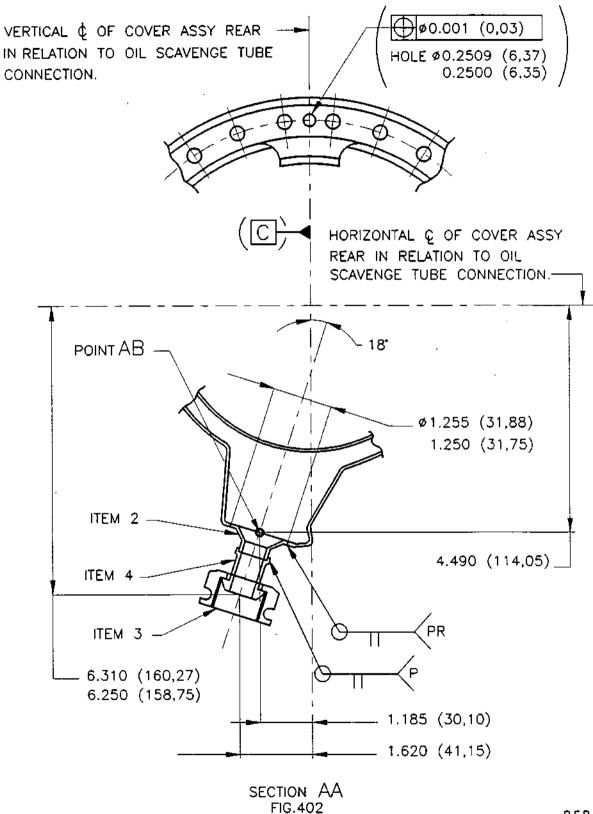
| DESCRIPTION | QUANTITY | PART NO. | ITEM |
|---|--------------|-------------------------------|-------------|
| SELF LOCKING SHANK NUT DRAIN BOSS UNION NUT | 12 1 1 | AS27859 B442828 B442829 | 1 2 3 |
| FERRULE | 1 | B442830 | 4 |





GENERAL VIEW OF COVER ASSEMBLY FIG.401

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REPAIR 72-52-03 Repair No.9 Page 405 Dec 1/91



SLEEVE, ASSEMBLY OF

PROVISION FOR REPLACEMENT OF DEFECTIVE AIR SUPPLY BOSS

REPAIR NO. B514697

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-52-03

2 130A

B440050

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- 1) Set sleeve, assembly of true to Refer fig. 401 datums A and B. Note: Air supply boss is located at T.D.C.
- 2) Machine out defective boss to centre of original weld line.
- 3) Deburr (Do not chamfer).
- 4) Obtain replacement boss.

Refer Para.8. Replacement Parts, item 1.

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Repair No. 10
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| 5) | Prepare areas | for | weldi | ng by |
|----|----------------|------------|-------|-------|
| | abrading with | abra | sive | matt |
| | and degreasing |) - | | |

Refer TSD 594 OP.101 and 409.

6) Assemble replacement boss in position and tack weld. Refer TSD 594 OP.409 Use welding rod OMat 305 Refer fig.401

7) Dimensionally inspect for correct position of boss.

Refer fig.401

8) Inert gas arc weld boss into position.
weld group classification 1.

Refer TSD 594 OP.409 Use welding rod OMat 305 Refer fig.401.

9) Visually inspect weld for quality. Refer TSD 594 OP.409

10) Locally dye penetrant inspect repair area.

Refer TSD 594 0P.210

11) Radiographically inspect repair weld for defects. Refer TSD 594 0P.409

- 12) Heat treat component at 700°C + 5°C for 2 hours in air. Cool in air.
- 13) Dye penetrant inspect component.

Refer TSD 594 0P.210

.14) Set sleeve, assembly of true to datums A and B and finish machine replacement boss to dimensions shown.

Refer fig.401

15) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.210

16) Dimensionally inspect.

Refer fig.401

17) Mark Repair Instruction number RI B514697 or R10 on component adjacent to normal 'assy of' number using the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. 5. MATERIAL

COMPONENT

MATERIAL

RR CODE

SLEEVE, ASSY OF

NICKEL ALLOY MSRR7004 QAJ

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

B419501

BOSS, FLANGED

1

1

B435148 (ALT)

BOSS, FLANGED

REPAIR 72-52-03 Repair No. 10 Page 403 Jun 1/92



FOR INSPECTION PURPOSES THE COMPONENT MAY BE MEASURED IN A CONSTRAINED OR AS ASSEMBLED CONDITION. \$\phi 2.005(50,93)\$
2.000(50,80) 0.010(0,25) A B 25° ø1.580 (40,13) 32(0,8) ⊕|ø0.005(0,13)|A | B Ø1.551(39,40) 1.550(39,37) GROUP 1 ITEM 1 5.265 TO Q $([133, \overline{73}])$ 1.215 30° (130.86)В

TYPICAL SECTION THRU SLEEVE, ASSY OF FIG.401

REPAIR 72-52-03 Repair No. 10 Page 404 Jun 1/92



SOCKET, AIR FEED

RESTORATION OF SEAL LOCATION BORE BY CHROMIUM PLATING

REPAIR NO. B514743

1. EFFECTIVITY

IPC Fig./Item Part No.

72-52-03 2 20A B435134 B435150

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair may be embodied any number of times provided that stated dimensions are not exceeded (refer fig. 403 to 405).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

REPEAT REPAIRS ONLY (For new arisings proceed to op.3).

1) Mask off all areas except area AD and strip existing chromium plating. Use solution specified for Nickel base alloys. Note: This Socket is manufactured in Cobalt based alloy.

Refer TSD 594 OP.308. Refer fig.403.

2) Locally etch area AD to ensure plating has been completely removed. Refer Overhaul Manual Chapter 72-09-14 Repair Solution E.

REPAIR

72-52-03
Repair No. 11
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Jun 1/92

NEW ARISINGS ONLY (For repeat repairs proceed to op.5).

Set housing true to datum A.

Refer fig. 401 to 403.

4) Machine defective location bore diameter. Remove the minimum amount of material to remove fretting; ensure minimum preplating diameter and wall thickness limitations are

Refer fig. 401 to 403.

 Dimensionally inspect repair area. Refer fig. 403.

Locally crack detect repair area. Refer Overhaul Manual Chapter 72-52-03 Inspection/Check

7) Chromium plate area AD.

maintained.

Refer TSD 594 OP.308. Refer fig.403.

- (a) Plating must not encroach within area AE.
- (b) Use pre-plating etch solution specified for Nickel base alloys. Note: This Socket is manufactured in Cobalt based alloy.

8) Set housing true to datum A.

Refer fig.401 to 403.

9) Machine plated repair area to finished dimensions. Refer TSD 594 OP.308. Refer fig.401 to 405.

10) Machine to clean up edge of plating in bore (if required). Note: To minimise material removal, set original unplated area of bore AE to run true.

Refer fig.403 and 405.

11) Dimensionally inspect.

Refer fig. 401 to 405.

12) Visually inspect plated area AD.

Refer TSD 594 OP.308. Refer fig.403. 13) Crack detect.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check

14) Mark Repair Instruction number RI B514743 or R11 and coating identity symbol adjacent to the normal 'assy of' no.
Use the electro-chemical marking or vibro-percussion engraving techniques.

Refer Overhaul Manual Chapter 72-09-00 Repair Refer fig.401.

Coating identity symbol CR

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

SOCKET, AIR VENT

HAYNES 25 BSEM 699

6. DATA

NOT APPLICABLE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

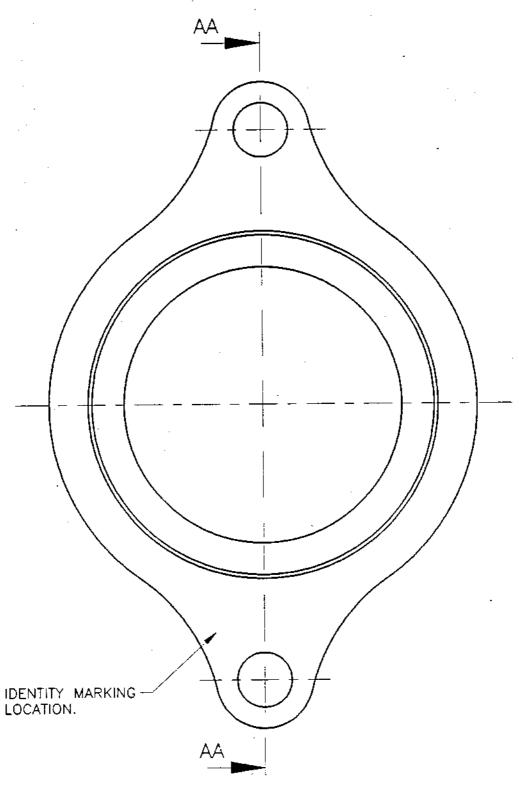
DESCRIPTION

QUANTITY

ITEM

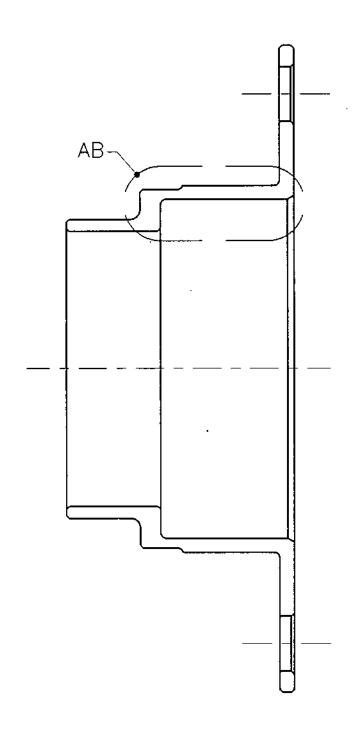
NONE.





SOCKET, AIR FEED FIG.401

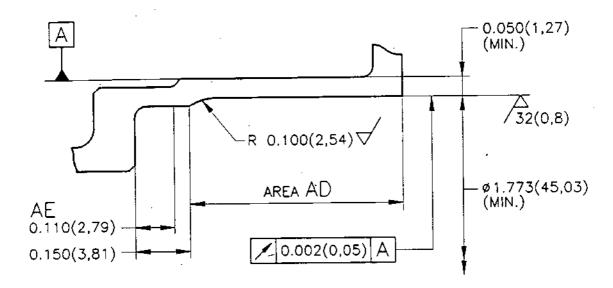
REPAIR
72-52-03
Repair No. 11
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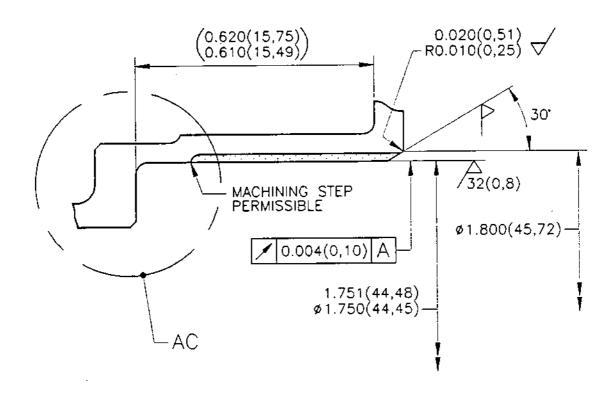
SECTION AA FIG.402

72-52-03 Repair No. 11 Page 405 Jun 1/92



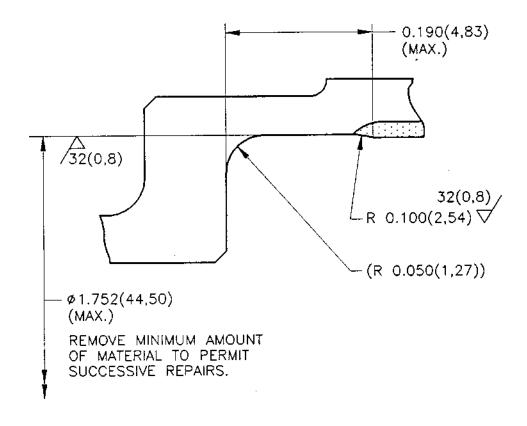


DETAIL AB FIG.403

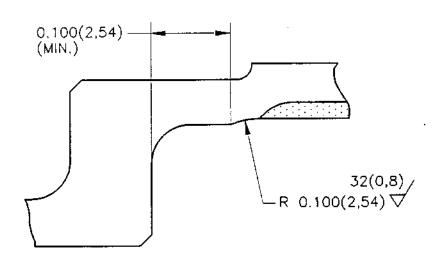


REPEAT DETAIL AB

REPAIR 72-52-03 Repair No. 11 Page 406 Jun 446



DETAIL AC



REPEAT DETAIL AC

PERMISSIBLE MACHINING STEPS FIG.405

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SOCKET, VENT

RESTORATION OF SEAL LOCATION BORE BY PLASMA SPRAY

REPAIR NO. B514744

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-52-03

2 40A

B445406

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair may be embodied any number of times provided that stated dimensions are not exceeded (refer fig.403 and 404).

3. **GENERAL**

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Set housing true to datum A.

Refer fig.401 to 403.

2) Machine defective location bore diameter. Remove the minimum amount of material to remove fretting. If a repeat repair is being carried out ensure all existing coating is removed. Ensure pre-coating diameter and wall thickness limitations are maintained.

Refer fig. 401 to 403.

REPAIR
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Repair No. 12
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3) Locally etch area AD to ensure complete removal of coating. Note: This operation is required for repeat repairs only. Refer Overhaul Manual Chapter 72-09-14 Repair Solution E. Refer fig 403.

 pimensionally inspect repair area. Refer fig.403.

5) Locally crack detect repair area.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check

6) Plasma spray bore at location AD to a sufficient thickness to ensure the final machined diameter is achievable. Coating must not be deposited within area designated AE.

Refer TSD 594 OP 704. Use powder OMat 3/135. Refer fig.403.

7) Set housing true to datum A.

Refer fig.401 to 403.

8) Machine coated repair area to finished dimensions. Refer fig.403.

9) Machine to clean up edge of coating in bore (if required). Note: To minimise material removal set original uncoated area of bore to run true. Refer fig.403 and 404.

10) Dimensionally inspect.

Refer fig. 403 and 404.

11) Visually inspect coating for defects.

Refer TSD 594 OP 704.

12) Locally crack detect machined areas.

Refer Overhaul Manual Chapter 72-52-03 Inspection/Check

13) Mark Repair Instruction number RI B514744 or R12 and coating identity symbol adjacent to the normal 'assy of' no. Use the electro-chemical marking or vibro-percussion engraving techniques. Coating identity symbol HC

Refer Overhaul Manual Chapter 72-09-00 Repair Refer fig.402. 5. MATERIAL

COMPONENT

MATERIAL

RR CODE

SOCKET, VENT

HAYNES 25 BSEM 699

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

QUANTITY

ITEM

NONE.



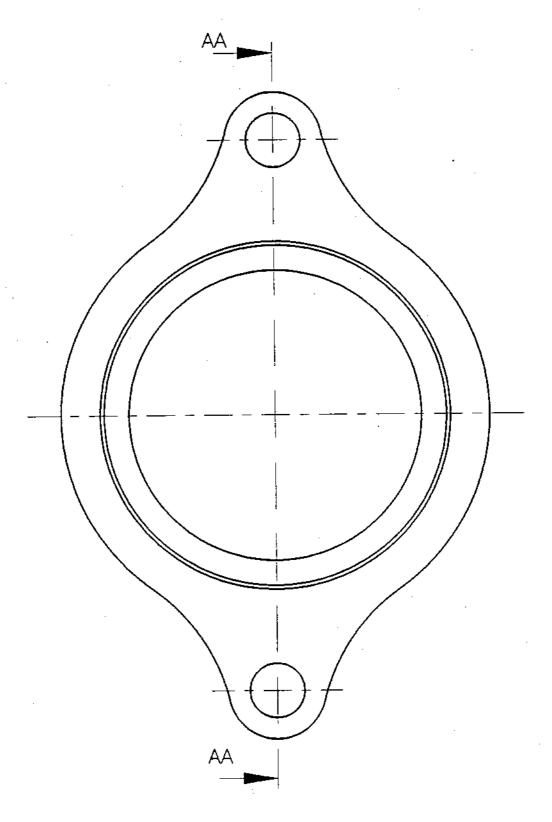
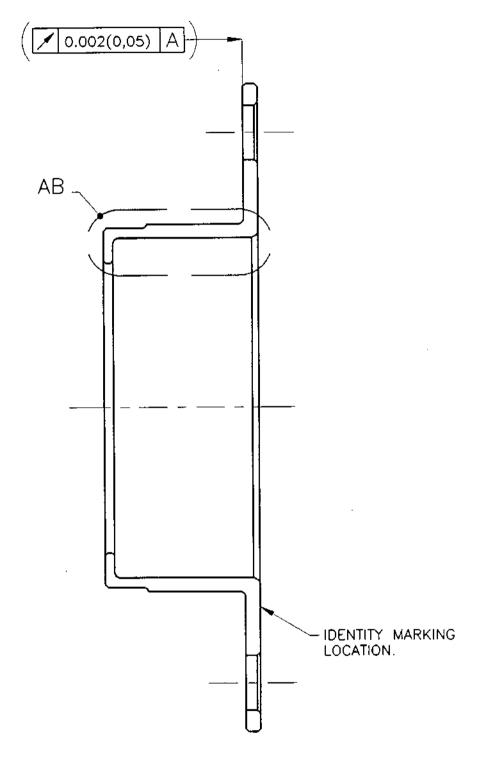


FIG 401

REPAIR 72-52-03 Repair No. 12 Page 404 Jun 1/92



SECTION AA

REPAIR 72-52-03 Repair No. 12 Page 405 Jun 1/92

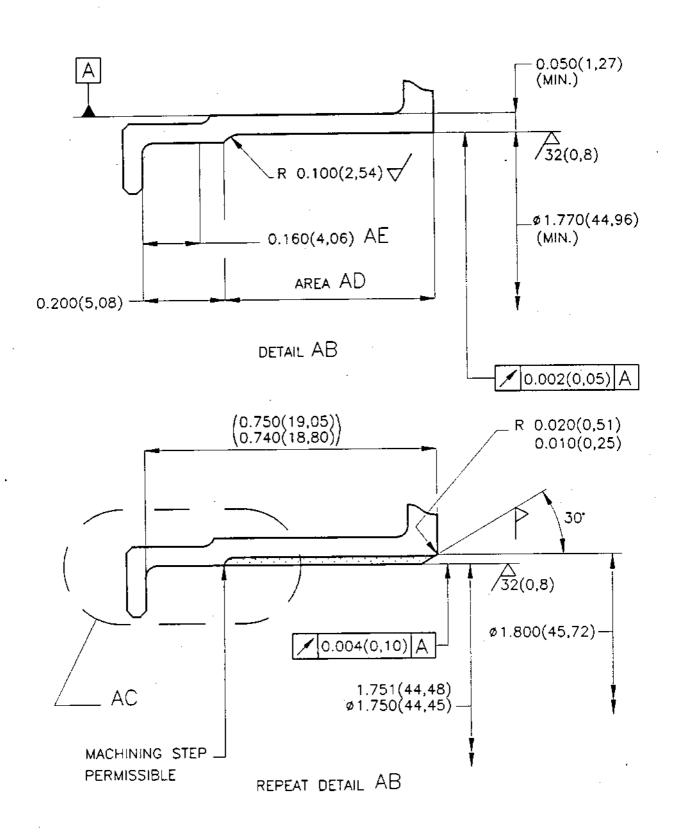
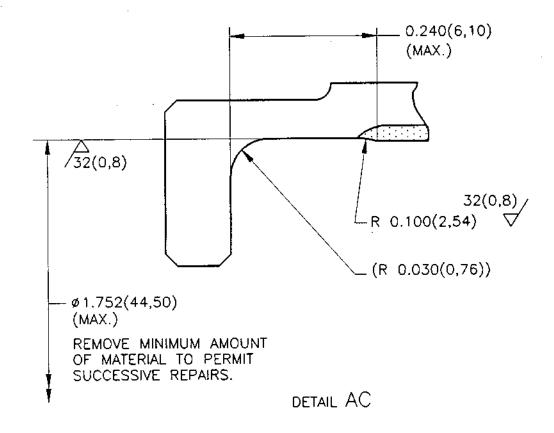
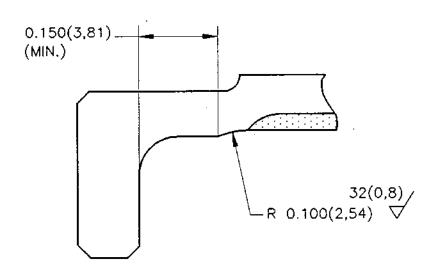


FIG 403





REPEAT DETAIL AC SHOWING MACHINING CONDITIONS AT OPPOSITE EXTREMES OF TOLERANCE

FIG 404

REPAIR 72-52-03 Repair No. 12 Page 407 Jun 1/92



TURBINE EXHAUST DIFFUSER ASSEMBLY - REPAIR

TABLE OF CONTENTS

| Repair No. | Title | Scheme No. |
|------------|--|-----------------|
| 1 | CANCELLED (See Table of Approved Schemes) | |
| 2 | Outer Case Repaired by Fitting Non-Standard Pins | SAL B.492906-11 |
| 3 | Repair Tube - Provision for Replacement of Ferrule | SAL B.493795-8 |
| 4 | Turbine Exhaust Diffuser - Repair by Replacement of Vane and Outer Vane End | SAL B.488643 |
| 5 | Turbine Exhaust Diffuser Repair by Welding of Tube Assembly Nut Wire Locking Lugs | SAL.B.493748 |
| 6 | Seal Housing Assembly - Blending of Damage to Seal Bush | SAL.B.935549 |
| 7 | LP Turbine Bearing Oil Scavenge Tube - Restoration of Location Diameter by Welding | SAL.B.506313 |
| 8 | Cold Vent Tube - Restoration by Replacing Locating Sleeve | SAL.B.507100 |
| 9 | Turbine Exhaust Diffuser - Fretting of Outer Case Removed by Blending | SAL.B.512728 |
| 10 | Housing, Seal Restoration of Housing, Seal Bore by Plasma Spray | SAL.B.513674 |
| 11 | Duct, Assy of. Repair of Cracks in Flange Outer and/or Weld Joint of Flange Inner | SAL.B.513673 |
| 12 | Diffuser Assy. of, Inner, Turbine Exhaust. Repair of impact damage and/or cracking by blending and/or welding | SAL.B.514577-8 |

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| Repair No. | . Title | Scheme No. |
|------------|---|--------------|
| 13 | Tube. Repair of damage to spherical sleeve location diameter by welding | SAL.B.515008 |
| 14 | Duct, Assy of. Remove and replace damaged end fitting | SAL.B.516913 |
| 15 | Housing Seal, Assy of - Remove and Replace Worn Bush (Post Mod.72-8588 STD) | SAL.B.517938 |

TURBINE EXHAUST DIFFUSER ASSEMBLY - REPAIR OUTER CASE REPAIRED BY FITTING NON-STANDARD PINS

1. Effectivity

| I.P.C. | Fig. | /Item | Part No. |
|----------|------|-------|----------|
| 72-53-00 | 04 | 230B | B.926613 |
| | 04 | 230C | B.922157 |
| | 04A | 230D | B.927138 |

2. Authority:

Modification No.OL.8438C

3. Introduction

- A. This Repair describes the procedure for repairing pin locations in the exhaust diffuser outer case, by opening the defective locations to receive pins which are oversize on the fast-end diameter.
- B. Refer to Chapter 72-09-00, Repair for all standard practices and tolerancing applicable to this repair procedure.
- C. Dimensions are shown thus: INCHES (MILLIMETERS).

4. Instructions

- A. Prepare Defective Locations (Ref.Fig.401).
 - (1) Measure the defective locations to determine the minimum oversize dimension required (Ref.Table 401); this will permit successive repairs.
 - (2) Location X only (SECTION AA-AA).
 - (a) Locate the case on its large flange face on a jig boring machine.

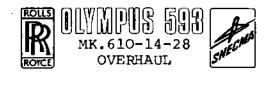
PN 333



- (b) Set true to the defective pin location.
- (c) Finish bore the location to the selected oversize diameter.
- (d) Remove burrs and sharp edges.
- (3) Location Y only (SECTION AB-AB).

NOTE: One or both locations may be repaired.

- (a) Locate the case on its large flange face on a jig boring machine.
- (b) Set true to the defective location to be bored.
- (c) Finish bore the location to the selected oversize diameter.
- (d) Remove burrs and sharp edges.
- (4) Inspect for satisfactory completion of all previous operations.
- (5) Test the case for cracks by the fluorescent dye process specified for this component in 72-53-00, Inspection/Check.
- B. Fit Oversize Fast-End Pins.
 - (1) Select the correct non-standard pins for the locations prepared (Ref. Table 401).
 - (2) Freeze and fit the pins to the case.
 - (3) Inspect to ensure that all pins have been fitted correctly.
 - (4) Repeat the test for cracks.
- C. Identify repair (Ref.Table 401). Mark the appropriate repair scheme numbers close to the standard part number on the case.



| LOCN. (REF. FIG. 401) | REPAIR SCHEME NUMBER | AMOUNT OVERSIZE | DIAMETER RANGE | NON-STD. PIN REQ'D. |
|--------------------------------|----------------------------|--------------------|----------------------------------|-------------------------|
| | SAL B.492906 | 0.010 (0,254) | 0.1669 (4,239) 0.1662 (4,221) | B.492912 OR B.492913 |
| X | SAL B.492907 | 0.015 (0,381) | 0.1719 (4,366) 0.1712 (4,348) | B.492914 OR B.492915 |
| | SAL B.492908 | 0.020 (0,508) | 0.1769 (4,493) 0.1762 (4,475) | B.492916 OR B.492917 |
| , | SAL B.492909 | 0.010 (0,254) | O.2592 (6,584) O.2586 (6,568) | B.492918 |
| Y | SAL B.492910 | 0.015 (0,381) | 0.2642 (6,711) 0.2636 (6,695) | в.492919 |
| | SAL B.492911 | 0.020 (0,508) | O.2692 (6,838) O.2686 (6,822) | B.492920 |

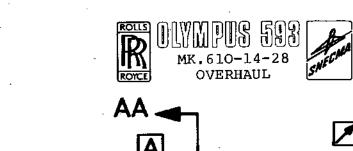
Table 401

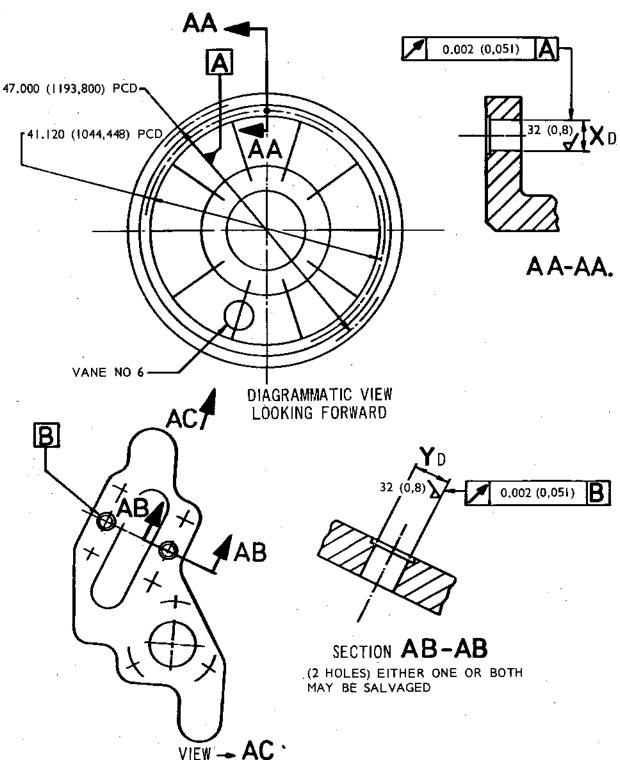
5. Special Tools, Fixtures and Equipment

| Description | Quantity | Tool No. | <u>Item</u> |
|-------------|------------|---------------|-------------|
| Plug Gauge | 1 | S3S15013000 | 1 |
| Plug Gauge | 1 | S3S15014000 | 2 |
| Plug Gauge | 1 | S3S15015000 | 3 |
| Plug Gauge | · 1 | S3S15008000 | 4 |
| Plug Gauge | 1 | \$3\$15009000 | 5 |
| Plug Gauge | 1. | S3S15007000 | 6 |
| | | | |

- A. SAL B.492906. Use item 1.
- B. SAL B.492907. Use item 2.

72-53-00 Repair No.2 Page 403 Apr 1/77





Outer Case - Fitting Non-Standard Pins Figure 401

72-53-00 Repair No.2 Page 404 Apr 1/77



C. SAL B.492908. Use item 3.

D. SAL B.492909. Use item 4.

E. SAL B.492910. Use item 5.

F. SAL B.492911. Use item 6.

6. Replacement Parts

Description Quantity

Shouldered Pin As req'd. Ref. Table 401

Part No.

72-53-00 Repair No.2 Page 405 Apr 1/77



TURBINE EXHAUST DIFFUSER ASSEMBLY - REPAIR TUBE - PROVISION FOR REPLACEMENT OF FERRULE MODIFICATION OL.8545C

Effectivity

I.P.C. Fig./Item

Part No.

72-53-00

1/1A 420 A/B/C/D

B.466738, B.466740, B.479400, B.489177

___,

2. Introduction

A. General.

- (1) This repair describes the procedure for replacing tube assembly ferrules that have fretted in service.
- (2) The damaged ferrule is removed by cutting through the tube, the end of the tube is then produced square to the tube axis.
- (3) The replacement joint tube and ferrule are then located and mechanically argon arc welded in position.
- (4) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETRES).
- (5) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (6) Details of the tools, referred to by item number in this repair procedure, can be found in para.4.
- (7) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm), unless otherwise stated.
- (8) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (9) Place the tube assembly in a suitable protective container during transit between operations to avoid damage.



- B. Repair Limitations.
 - (1) There are no limitations to the number of times this repair may be carried out on an individual component.

3. Instructions

- A. Remove Existing Tube Section and Damaged Ferrule.
 - (1) Scribe a line 1.700 in. (43,18 mm) (Ref.Fig.401) from the ferrule end of the tube assembly.

NOTE: This dimension allows for trimming.

- (2) Cut through the tube on the ferrule side of the scribed line and trim to the scribed line using conventional hand tools.
- (3) Remove any burrs using conventional hand tools.
- B. Attach Joint Tube.
 - (1) Select the appropriate replacement joint tube (Ref. Table 401).
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease using Genklene.

| SCHEME NO. | JOINT TUBE | FERRULE | TUBE ASSEMBLY |
|--|--|--|--|
| The parts i | n this table are | not interchan | geable. |
| B. 493795 B. 493796 B. 493797 B. 493798 | B.493668L10 B.493668L10 B.493669L10 B.493669L10 | B.437282 B.437282 B.479402 B.489178 | B. 466738 B. 466740 B. 479400 B. 489177 |

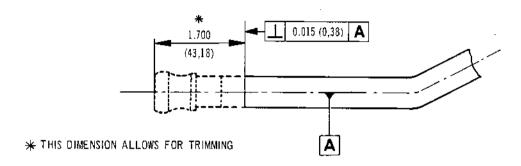
Replacement Parts Table 401

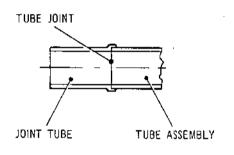


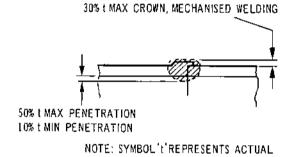
- (3) Assemble replacement joint tube to existing tube assembly; ensure nuts are still on tube assembly and are correctly assembled.
- (4) Tackweld, diametrically opposite, the joint tube to the existing tube assembly; refer to para.6 for welding data (Fig. 401).
- (5) Check the joint tube and tube assembly for alignment.
- (6) Autoweld the replacement joint tube to the existing tube assembly; refer to para.6 for welding data.
- (7) Visually inspect the welded tube assembly to ensure that the welding operation has been satisfactorily carried out.
- (8) Test the welded area for cracks by the fluorescent dye penetrant process specified for this component in 72-53-00 Inspection/Check.
- (9) Carry out a non-destructive radiological (X-ray) test on the component.

C. Attach Ferrule.

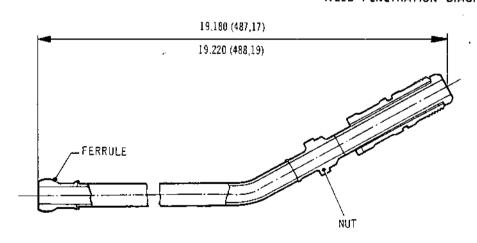
- (1) Select the appropriate replacement ferrule (Ref. Table 401).
- (2) Assemble replacement ferrule to tube assembly and position on the layout board, ref. tool item 1.
- (3) Check and if necessary dress the tube assembly to achieve the 19.180 in./19.220 in. (487,17 mm/ 488,19 mm) dimension as shown in Fig.401 using conventional hand tools.
- (4) Polish weld mating surfaces with clean fine grade Scotchbrite and degrease with Genklene.
- (5) Tackweld diametrically opposite the replacement ferrule to the tube assembly; refer to para.6 for welding data.







PARENT METAL THICKNESS
WELD PENETRATION DIAGRAM



DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Replacement Joint Tube and Ferrule Attachment Figure 401

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- (6) Check the ferrule and tube assembly for alignment.
- (7) Autoweld the replacement ferrule to the tube assembly; refer to para.6 for welding data.
- (8) Check the tube assembly for distortion.
- (9) True up the tube assembly as necessary, using conventional hand tools.

CAUTION: CARE MUST BE TAKEN NOT TO REDUCE THE TUBE SECTION WHEN POLISHING.

- (10) Clean the tube assembly by polishing with clean fine grade Scotchbrite.
- (11) Visually inspect the tube assembly to ensure that the welding operation has been carried out satisfactorily.
- (12) Test the welded area for cracks by the fluorescent dye penetrant process specified for this component in 72-53-00 Inspection/Check.
- (13) Carry out a non-destructive radiological (X-ray) test on the component.
- D. Clean Tube Assembly.
 - (1) Clean the tube assembly as specified for this component in 72-53-00 Cleaning.
 - (2) Visually inspect the tube assembly to ensure the cleaning operation has been satisfactorily carried out.

E. Identify.

(1) Using the electro-chemical marking technique (Ref.72-09-00 Repair) mark the repair scheme number (Ref. Table 401) or R3 adjacent to the standard part number.

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F. Finally Inspect.

- (1) Finally inspect the tube assembly to ensure the repair has been carried out satisfactorily and that the tube assembly is in a serviceable condition. The ball diameter of the tube assembly must be determined by the maximum permissible height of the weld underbead (Ref. Fig. 401), and a ball of this diameter must be passed without obstruction from one end of the tube assembly to the other. It is important to ensure that the ball is not inadvertently left in the tube assembly.
- (2) Generally clean the tube assembly to remove grease and foreign bodies, then blank the tube ends and store as required.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u>ltem</u> | Fig. |
|--------------------|----------|--------------|-------------|------|
| Layout Board | 1 | S3S.15562000 | 1 | 401 |

5. Replacement Parts

| Description | <u>Quantity</u> | Part No. | I.P.C. Fig./Item |
|---|---|----------|------------------|
| Ferrule Ferrule Ferrule Joint Tube Joint Tube | As Req'd. As Req'd. As Req'd. As Req'd. As Req'd. | | |



6. Welding Data

| SCHEME NO. | JOINT TUBE | FERRULE | TUBE ASSEMBLY | WELDING PROCESS REQUIRED |
|------------|------------------|--------------|------------------|--------------------------------|
| The parts | in this table ar | e not interc | hangeable. | |
| в.493795 | B.493668L10 | B.437282 | B.466738 | А |
| в.493796 | B.493668L10 | B.437282 | B.466740 | Α |
| B.493797 | B.493669L10 | B.479402 | B.479400 | В |
| B.493798 | B.493669L10 | B.489178 | B.489177 | В |

Welding Processes Requirements Table 402

A. Process A.

(1) Component:

Tube assembly of.

(2) Machine:

Hirschman.

(3) Current:

27 amps.

(4) Welding speed:

Low. 3.0 in./min. (76,20 mm/min.).

(5) Number of orbits:

2.25 before crater.

(6) Electrode:

0.0625 in. (1,587 mm) Thoriated tungsten - VE

(7) Arc length:

0.030 to 0.040 in. (0,762 to 1,016 mm).

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- (8) Gas cup: Mouth organ shield.
- (9) Argon to head:
 30 cu ft/hr. or 15 litres/min.
- (10) Argon to backing:
 10 cu ft/hr. or 5 litres/min.
- (11) Backing pressure:
 0.072/sq.in. or 504 kPa.
- (12) Torch:
 B.O.C. Mk.11A.

B. Process B.

- (1) Component:
 Tube assembly of.
- (2) Machine:
 Hirschman.
- (3) Current:
 34 amps.
- (4) Welding speed:
 Low. 3.0 in./min. (76,20 mm/min.).
- (5) Number of orbits:2.5 before crater.
- (6) Electrode:
 0.0625 in. (1,587 mm) Thoriated tungsten VE.



- (7) Arc length:
 0.030 to 0.040 in. (0,762 to 1,016 mm).
- (8) Gas cup: Mouth organ shield.
- (9) Argon to head:
 30 cu ft/hr. or 15 litres/min.
- (10) Argon to backing:
 10 cu ft/hr. or 5 litres/min.
- (11) Backing pressure:
 0.072/in. sq. or 504 kPa.
- (12) Torch:

 B.O.C. Mk.llA,



TURBINE EXHAUST DIFFUSER - REPAIR REPLACEMENT OF VANE AND OUTER VANE END

MODIFICATIONS NO.OLY.8666C AND 8699C

1. Effectivity

| I.P.C. | Fig. | /It <u>em</u> | Part No. |
|----------|------|---------------|--|
| 72-53-00 | 9 | 40B | B.925617 |
| | 9 | 40c | B.926879 B.926892 B.926895 B.926896 |

2. Introduction

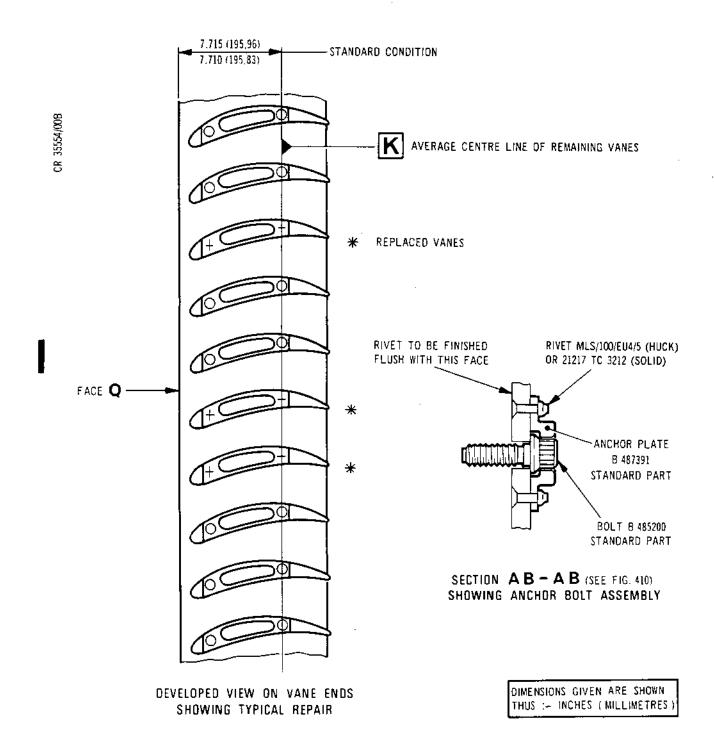
A. General.

- (1) This repair describes the procedure for replacing a vane and outer vane end to restore the Inner Turbine Exhaust Diffuser to a serviceable condition.
- (2) The damaged existing vane and outer vane end are removed by cutting and machining, and replacements welded into position.
- (3) Dimensions are shown thus in tables and illustrations: INCHES (MILLIMETERS).
- (4) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (5) Details of the tools, referred to by item number in this repair procedure, can be found in para.4.
- (6) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0.508 mm) unless otherwise stated.
- (7) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm), unless otherwise stated.
- (8) Surface texture of machined surfaces to be 125 microinches (3,2 micrometers), unless otherwise stated.
- (9) Tolerances on angles are plus/minus 2 degrees unless otherwise stated.

REPAIR

72-53-00





Vane Ends and Anchor Bolts Figure 401

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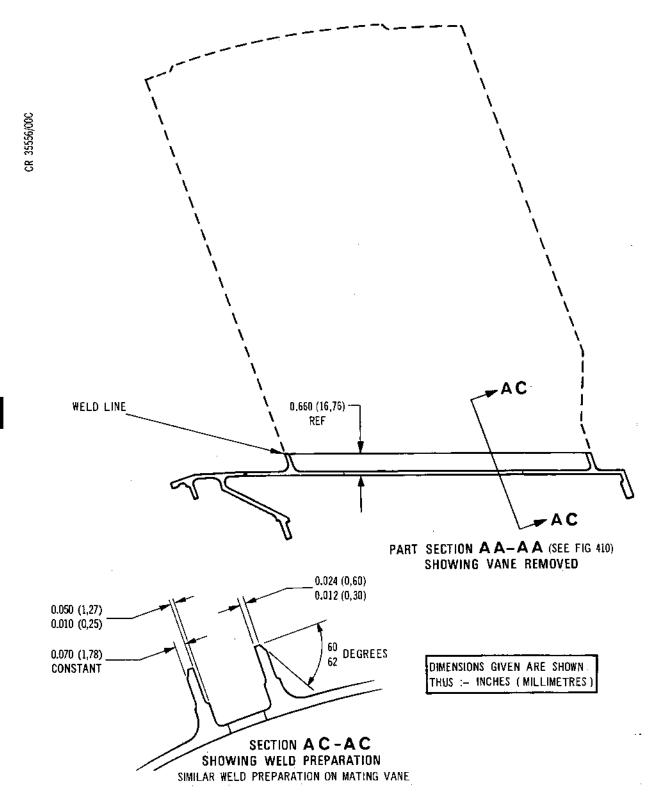
- B. Repair Limitations.
 - (1) A maximum of three vanes may be replaced at any one time, two of which may be adjacent.

3. Instructions

- A. Remove Bolts and Anchor Plates.
 - (1) Using standard hand tools, remove the eight anchor plates and bolts from the rear flange (Ref.Fig.401). Discard the bolts. Retain the anchor plates for possible re-use (refer to paragraph 7).
 - (2) Inspect each of the vanes to be retained to ensure no broken bolts exist in the ends. If broken bolts are present they must be removed using the Electro Discharge Machining (EDM) technique.
- B. Remove Defective Vane.
 - (1) True up the Exhaust Diffuser to remove distortion sufficient for it to be fitted to inspection fixture ref. tool item 4 (Ref.Fig.408). Use conventional hand tools.
 - (2) Cut to remove the defective vane leaving a 0.118 inmachining allowance on the vane side of the existing weld line, using an elastic wheel and standard hand tools (Ref.Fig.402).
 - (3) Locate the Exhaust Diffuser in milling fixture ref. tool item 1 (Ref.Fig.403), and locate the fixture/ component assembly onto a milling machine.
 - (4) Mill to remove the remaining part of the defective vane. Position cutter to setting block using a 0.025 in. (0,64 mm) feeler gauge between the cutter and setting block (Ref.Fig.402 and 403).
 - (5) Remove burrs and any surplus weld bead without reducing the parent material, and produce the weld preparation shown on Fig. 402.
 - (6) Test the prepared area for cracks using the fluorescent dye penetrant process specified for this component in 72-53-00 Inspection/Check.
 - (7) Clean and degrease the Exhaust Diffuser; refer to 72-53-00 Cleaning for the relevant procedure.

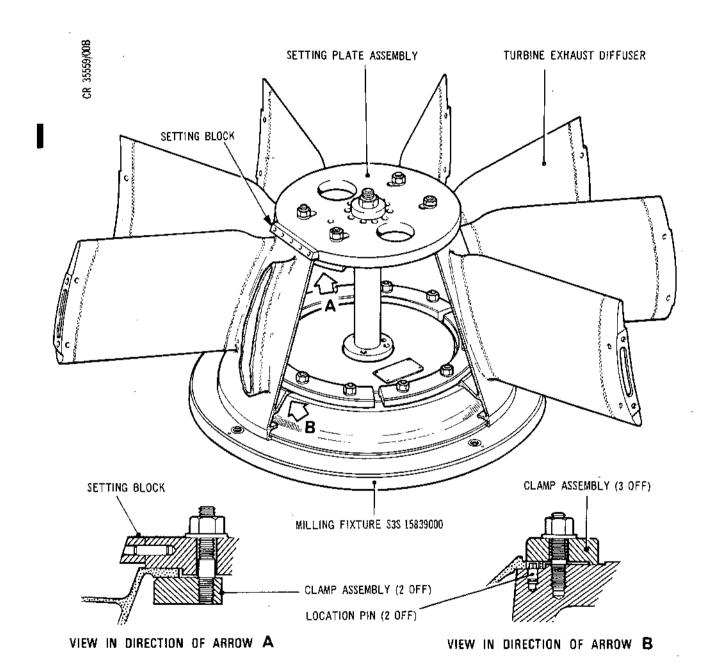
REPAIR





Vane Removal Figure 402

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Milling fixture Figure 403

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- (8) Inspect the Exhaust Diffuser to ensure the defective vane has been suitably removed and the correct parameters produced (Ref.Fig. 402).
- C. Weld a Replacement Vane to a Replacement Outer Vane End.
 - (1) Withdraw from stores a replacement vane B.397920 and outer vane end B.437367.
 - (2) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (3) Using welding fixture ref. tool item 2, assemble the replacement vane to the replacement outer vane end. Form the mating ends to ensure correct alignment, using conventional forming tools (Ref.Figs. 405 and 406). Ensure any mismatch does not exceed the limits shown at Fig. 404.
 - (4) Starting at the mid-point of the concave and convex sides and alternating from side to side in a diagonally opposite sequence, tackweld the replacement vane to the replacement outer vane end; refer to para.6, process A, for welding data.
 - (5) Remove the replacement vane/outer vane end assembly from the fixture.
 - (6) Check to ensure no excessive mismatch exists (Ref. Step 3). If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible then the tackwelds must be broken to separate the vane and the outer vane end, then after suitable dressing and cleaning the tackwelding procedure repeated.
 - (7) Weld the replacement vane to the replacement outer vane end, by joining two tacks at the mid-point of the convex side, followed by two tacks at the mid-point of the concave side, then alternate from side to side in a diagonally opposite sequence, joining two tacks each time; refer to para.6, process A, for welding data.

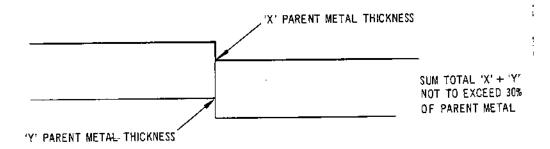
72-53-00

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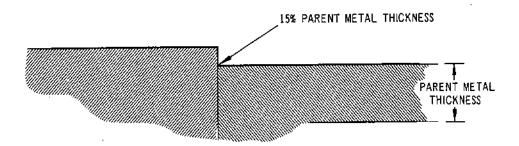
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DOUBLE STEP-MANUAL AND MECHANISED WELD JOINTS

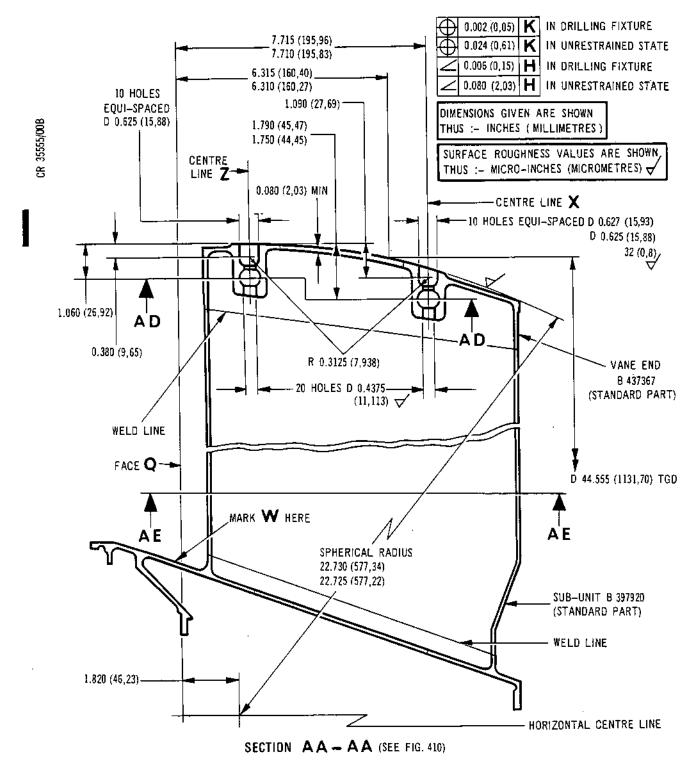


STEP CONDITION WHEN ONLY ONE SIDE CAN BE INSPECTED

Maximum Acceptable Mismatch When Welding Figure 404

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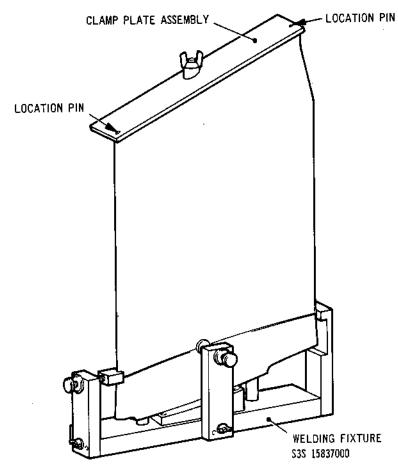


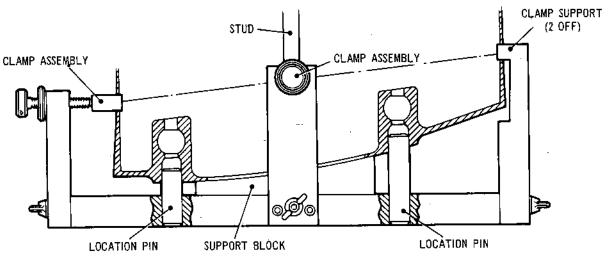


Replacement Vane and Vane End Figure 405

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SECTION SHOWING VANE LOCATION

Welding Fixture Figure 406

72-53-00

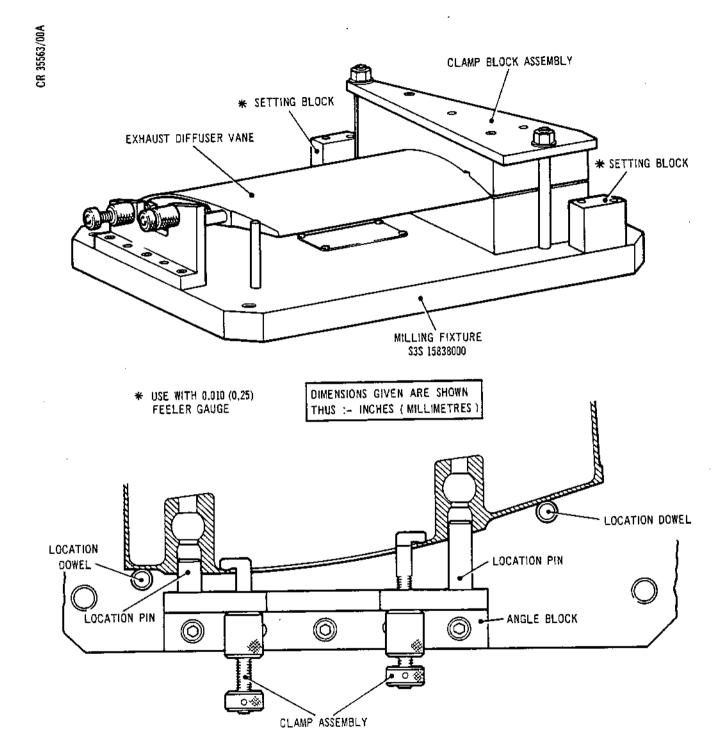
Repair No.4

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- (8) Check that the correct amount of weld protrusion has been achieved. There must be complete penetration, but it must be kept to a minimum. The weld must not be dressed except where indicated on Fig.413. If the weld protrusion is unsatisfactory, and cannot be corrected by a weld re-run then the two parts must be separated by cutting and machining, as detailed previously, and the whole procedure repeated.
- (9) Test the welded area for cracks using the fluorescent dye penetrant process specified for this component in 72-53-00 Inspection/Check.
- (10) Carry out a non-destructive radiological (X-Ray) examination of the welded area (group 2 weld).
- (11) Inspect the vanes as detailed in paragraph 36.
- D. Heat Treat.
 - (1) Heat treat the Exhaust Diffuser to 800 deg.C. plus/ minus 5 deg.C. for 8 hours. Cool in air.
- E. Machine Vane/Outer Vane End Assembly.
 - (1) Locate the vane/outer vane end assembly to milling fixture ref. tool item 3, ensuring it is located tight against the location dowels (Ref.Fig.407), and locate the component/fixture assembly onto a milling machine. Ensure the fixture is located with the setting blocks in the same plane as the milling cutter.
 - (2) Set the milling cutter against the setting blocks, with a 0.010 in. (0,25 mm) feeler gauge between the blocks and the milling cutter, and mill the vane/outer vane end assembly.
 - (3) Remove the vane/outer vane end assembly from the fixture.
 - (4) Remove burrs and produce the weld preparation shown on Fig.402.
 - (5) Inspect the vane/outer vane end assembly to ensure it has been machined satisfactorily, with no damage, and that the weld preparation shown at Fig. 402 has been produced.





SECTION SHOWING VANE LOCATION

Milling Fixture Figure 407

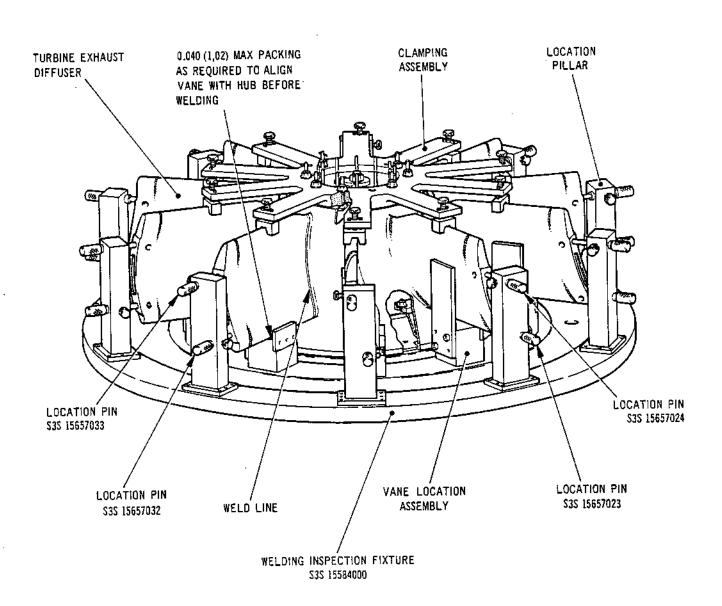
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Welding/Inspection Fixture Figure 408

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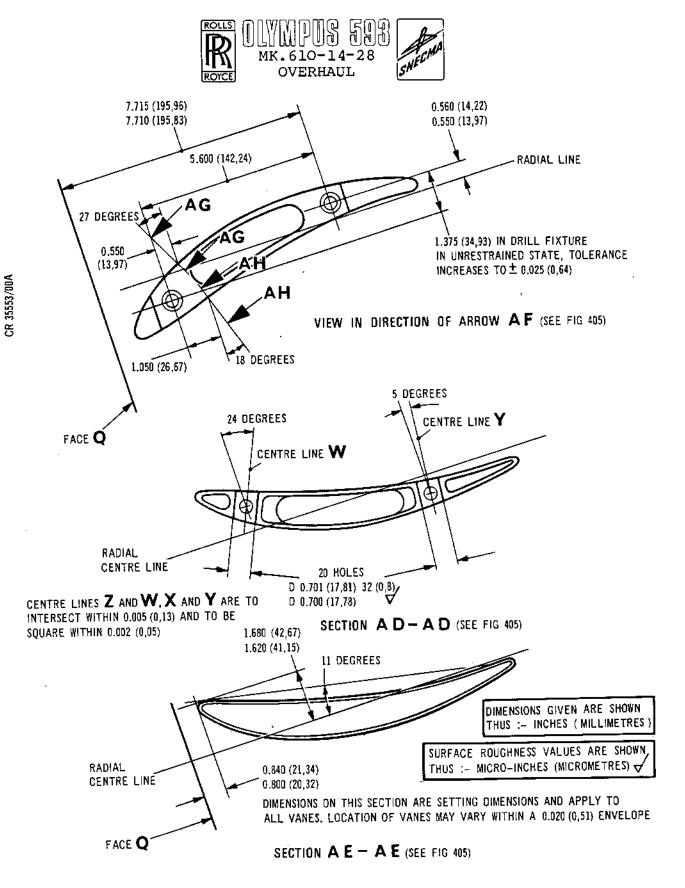
- F. Weld the Vane/Outer Vane End Assembly to Inner Hub.
 - (1) Polish the mating surfaces using clean fine grade Scotchbrite and locally degrease with Genklene.
 - (2) Using welding/inspection fixture ref. tool item 4, assemble the vane/outer vane end assembly to the inner hub. Use pins ref. tool item 5 to support existing vanes and pins ref. tool item 6 to support the vane/outer vane end assembly (Ref.Fig. 408). Form the mating ends to ensure correct alignment using conventional forming tools. Ensure any mismatch does not exceed the limits shown at Fig. 404.
 - (3) Starting at the mid-point of the concave and convex sides and alternating from side to side in a diagonally opposite sequence, tackweld the vane/outer vane end assembly to the inner hub; refer to para.6, process A, for welding data.
 - (4) Remove the Exhaust Diffuser from the fixture.
 - (5) Check to ensure no excessive mismatch exists (Ref. Step 2). If excessive mismatch does exist, then the mating ends must be formed using conventional hand tools to remove any discrepancy. If this is not possible then the tackwelds must be broken to separate the vane/outer vane end assembly and the inner hub, then after suitable dressing and cleaning the tackwelding procedure repeated.
 - (6) Weld the vane/outer vane end assembly to the inner hub, by joining two tacks at the mid-point of the convex side, followed by two tacks at the mid-point of the concave side, then alternate from side to side in a diagonally opposite sequence, joining two tacks each time; refer to para.6, process A, for welding data.
 - (7) Check the correct amount of weld protrusion has been achieved. There must be complete protrusion, but it must be kept to a minimum. The weld must not be dressed except where indicated on Fig. 413. If the weld protrusion is unsatisfactory, and cannot be corrected by a weld re-run then the two parts must be separated by cutting and machining, as detailed previously, and the whole procedure repeated.

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Machining and Setting Details Figure 409

72-53-00

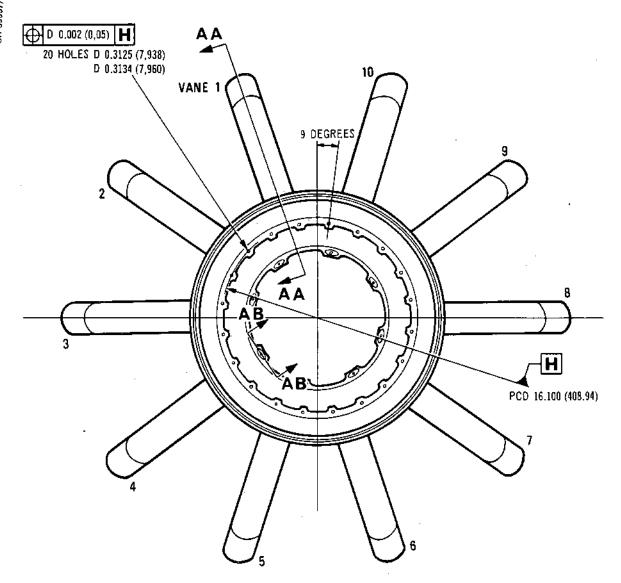
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CR 35557/00A



VIEW LOOKING REARWARD

DIMENSIONS GIVEN ARE SHOWN THUS:- INCHES (MILLIMETRES)

Turbine Exhaust Diffuser Figure 410

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- (8) True up the Exhaust Diffuser to remove distortion sufficient for it to be fitted to inspection fixture ref. tool item 4 (Ref.Fig.408). Use conventional hand tools.
- (9) Check the vane/outer vane end assembly has been welded in the correct position as shown at Section AE (Ref.Fig.409).
- (10) Test the welded area for cracks using the fluorescent dye penetrant process specified for this component in 72-53-00 Inspection/Check.
- (11) Carry out a non-destructive radiological (X-Ray) examination of the welded area (group 2 weld).

G. Inspect.

(1) Check vanes 2, 4, 5, 6 and 7 (Ref.Fig.410) for clearance, using the gauges detailed in Table 401 (Ref.Figs.411, 412 and 413).

| VANE NO. | TOOL REF. | FIG. NO. |
|----------|--|----------|
| 2 | Items 8 and 11 | 411 |
| 4 | Items 8 and 11 | 411 |
| 5 | Items 10 and 13 | 413 |
| 6 | Item 14 | 412 |
| 7 | Items 9 and 12 | 412 |
| | NOTE: Tools item 8, 9 and 10 must be used with tool item 20. | |

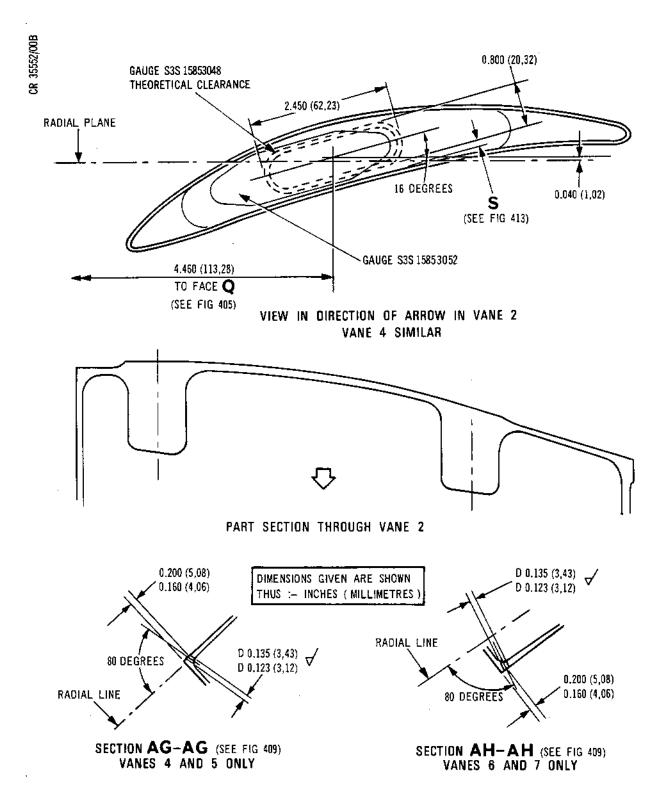
Inspection Gauges Table 401

H. Heat Treat.

- (1) Heat treat the Exhaust Diffuser to 800 deg.C. plus/ minus 10 deg.C. for 2 hours. Cool in air.
- (2) Crack test the Exhaust Diffuser using the fluorescent dye penetrant process specified for this component in 72-53-00 Inspection/Check.

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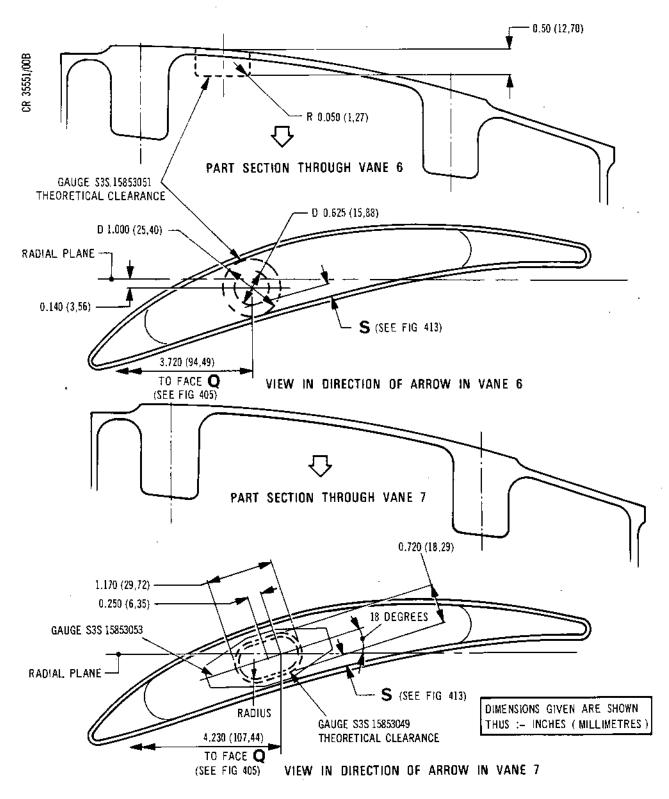




Vane and Machining Details Figure 411

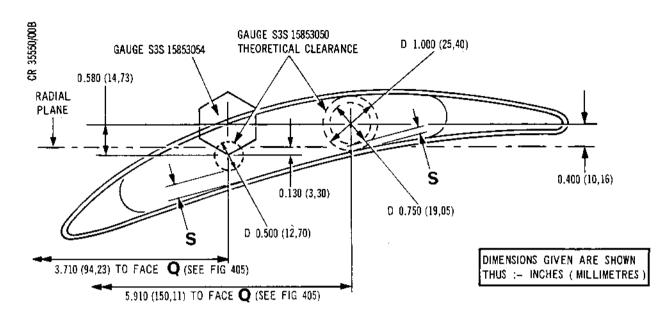
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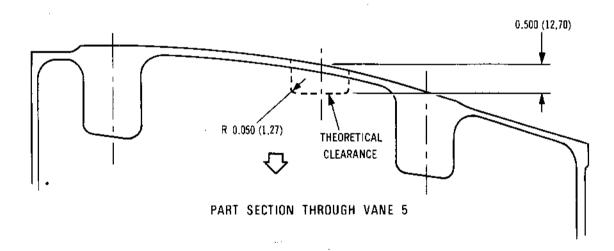


Vane Details Figure 412

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VIEW IN DIRECTION OF ARROW IN VANE 5



GAUGES, ITEMS 11, 12, 13 AND 14 USED WITH BEAM ASSEMBLY MUST PASS THROUGH RELEVANT VANE TO INDICATE REQUIRED THEORETICAL CLEARANCE (SHOWN DOTTED) OF PIPES, ETC.

IF GAUGES WILL NOT PASS THROUGH VANES THEN CORRECT CLEARANCE AT \$ 0.100 (2,54) HAS NOT BEEN ACHIEVED.

GAUGES, ITEMS 8, 9 AND 10 USED WITH GAUGE ROD ITEM 20 MUST BE CAPABLE OF PASSING THROUGH RELEVANT VANE BUT LOCATION AT WHICH THEY DO SO IS NOT IMPORTANT.

Vane Details Figure 413

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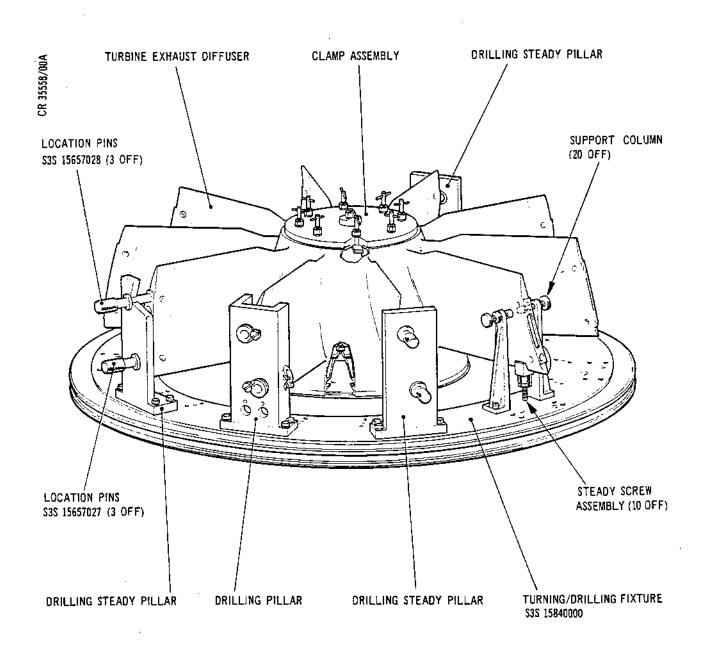
- J. Produce Spherical Radius on Replaced Outer Vane End.
 - (1) Locate the Exhaust Diffuser in turning fixture ref. tool item 15 (Ref.Fig.414), and locate the fixture/component assembly onto a profile lathe.
 - (2) Using a profile template turn to produce the 22.730 in. (577,35 mm) spherical radius (Ref.Fig. 405).
 - (3) Remove burrs.
 - (4) Check to ensure all parameters have been satisfactorily produced.

K. Drill Holes.

- (1) Locate the Exhaust Diffuser in fixture ref. tool item 15. Steady three existing vanes (two adjacent, one opposite) using pins ref. tool item 7, (Ref.Fig. 414).
- (2) Drill to produce the 0.4375 in. (11,1 mm) dia. holes, and counterbore 0.625 in. (15,87 mm) dia. using reamer ref. tool item 16 and cutter ref. tool item 17 (Ref.Fig.405).
- (3) Drill and ream to produce the 0.701/0.700 in. (17,8/17,78 mm) dia. holes, using reamer ref. tool item 18 (Ref.Fig.409).
- (4) Remove the Exhaust Diffuser from the fixture.
- (5) If vanes 4, 5, 6 or 7 (Ref.Fig.410) have been replaced, drill to produce the 0.135/0.123 in. (3,45/3,15 mm) dia, holes (Ref.Fig.411), using fixture ref. tool item 19 (Ref.Fig.415).
- (6) Remove burrs.
- (7) Check to ensure all parameters have been satisfactorily produced.

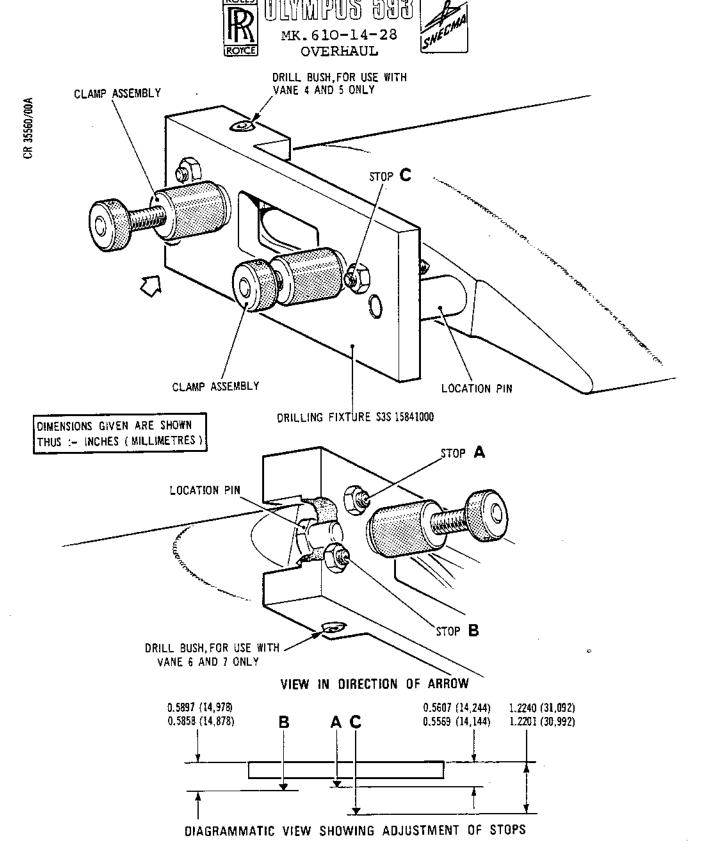
72-53-00 Repair No.4 Page 420 Mar 1/80





Turning/Drilling Fixture Figure 414

> 72-53-00 Repair No.4 Page 421 Mar 1/80



Drilling Fixture Figure 415

72-53-00

Repair No. 4

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L. Identify.

- (1) Using the electro-chemical marking technique, Ref. Chapter 72-09-00, Repair, mark on SAL B.488643 or R4 close to the existing part number. Also mark, in characters 0.200 in. (5,08 mm) high a 'W' as shown on Fig.405, to indicate the repaired vane. Subsequent repairs require the addition of a 'W' on each occasion.
- M. Replace Bolts and Anchor Plates.
 - (1) Withdraw from stores eight machine bolts B.485200, replacement anchor plates B.487391 as required, and 16 rivets MLS/100/EU4/5 (HUCK) or 21217 TC 3212 (solid).
 - (2) Secure the eight bolts and anchor plates with rivets using conventional hand tools (Ref. Fig. 401).
- N. Finally Inspect.
 - (1) Finally inspect the Exhaust Diffuser to ensure the repair has been carried out satisfactorily and that the Exhaust Diffuser is in a serviceable condition. The position of the 0.4375 in. (11,1 mm) dia. holes with 0.625 in. (15,8 mm) dia. counterbores can be checked using welding/inspection fixture ref. tool item 4 with pins ref. tool item 7.
 - (2) Place the Exhaust Diffuser in a suitable container and store as required.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Quantity | Tool No. | <u>Item</u> | Fig.No. |
|----------------------------|----------|----------------|-------------|---------|
| Milling Fixture | 1 | s3s.15839000 | 1 | 403 |
| Welding Fixture | 1 | S3S.15837000 | 2 | 406 |
| Milling Fixture | 1 | S3S.15838000 | 3 | 407 |
| Welding/Inspection Fixture | 1 | S3S.15584000 | 4 | 408 |
| Pins | 18 | S3S.15657023/4 | 5 | 408 |
| Pins | 6 | S3S.15657032/3 | 6 | 408 |
| Pins | 6 | S3S.15657027/8 | 3 7 | 414 - |
| Gauge | 1 | S3S.15853052 | 8 | _ |
| Gauge | 1 . | S3S.15853053 | 9 | _ |



| <u>Description</u> | Quantity | Tool No. | <u>Item</u> | <u>Fig.No.</u> |
|--------------------|----------|----------------|-------------|----------------|
| Gauge | 1 | S3S.15853054 | 10 | - |
| Gauge | 1 | S3S.15853048 | 11 | - |
| Gauge | 1 | S3S.15853049 | 12 | - |
| Gauge | 1 | \$3\$.15853050 | 13 | - |
| Gauge | 1 | S3S.15853051 | 14 | - |
| Turning Fixture | 1 | S3S.15840000 | 15 | 414 |
| Reamer | A/R | S3S.15855000 | 16 | - |
| Cutter | A/R | S3S.15856000 | 17 | _ |
| Reamer | A/R | S3S.15854000 | 18 | - |
| Drilling Fixture | 1 | S3S.15841000 | 19 | 415 |
| Gauge Rod | 1 | S3S.15853055 | 20 | - |

5. Replacement Parts

| . <u>Description</u> | <u>Quantity</u> | Part No. | I.P.C. Fig. | /Item |
|----------------------|-----------------|---------------|-------------|-------|
| Vane | A/R | B.397920 | 72-53-00 9 | -94A |
| Outer Vane End | A/R | B.437367 | 72-53-00 9 | -95A |
| Machine Bolt | 8 | B.485200 | 72~53-00 9 | 80A |
| Anchor Plate | 8 | B.487391 | 72-53-00 9 | 90 A |
| Rivet | 16 | MLS/100/EU4/5 | 72-53-00 9 | 50B |
| | or | 21217 TC 3212 | | |

Welding Data

A. Process A.

- (1) Method of Welding: Manual T.I.G. arc butt.
- (2) Welding Equipment: Type SAF 0389-004.
- (3) Current: 35-40 amps.
- (4) Electrode: 0.09375 in. (2,387 mm) diameter tungsten thoriated.
- (5) Filler Wire: MSRR 9500/16.
- (6) Argon to Torch: 10-15 litres/min (20-30 cu ft./hr).
- (7) Backing:
 20 litres/min (40 cu ft./hr).
- (8) Tackweld One tack every 0.8 in. (20 mm).

72-53-00

Repair No.4

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7. Serviceable Items

- A. Re-use of anchor plates B.487391 is permissible subject to the following inspection:
 - (1) Visually inspect anchor plates for signs of damage, cracking and corrosion. Pay particular attention to the condition of bolt head retaining feature and rivet holes. Nominal diameter of rivet holes is 0.0984 0.1040 in. (2,39 2,64 mm).
 - (2) Penetrant crack test all over. Refer to Chapter 72-09-00 (Inspection/Check) using the fluorescent dye penetrant process F1A. Cracks are not permitted.



1K.610-14-28 snecma OVERHAUL

TURBINE EXHAUST DIFFUSER ASSEMBLY - REPAIR BY WELDING OF THE TUBE ASSEMBLY NUT WIRE LOCKING LUGS

MODIFICATION NO. OL.88290

1. Effectivity

| I.P.C. | Fig./Item | <u>Part No.</u> |
|----------|--------------------|----------------------------------|
| 72-53-00 | 1A/420A | B.466740 B.466738 |
| | 1A/420B 1A/420C | B.479400 B.489177 |
| | 1A/420D | B.496177 B.496192 |
| | 2/030F | B.496185 B.497142 B.497146 |
| | | D.47(140 |

2. Introduction

A. General

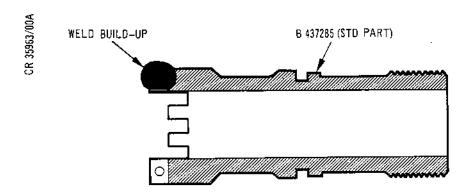
- (1) This repair describes the procedure (SAL.B.493748) for welding the tube assembly wire locking lugs to restore them to a serviceable condition.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,102 to 0,508 mm) unless otherwise stated.

B. Repair limitations

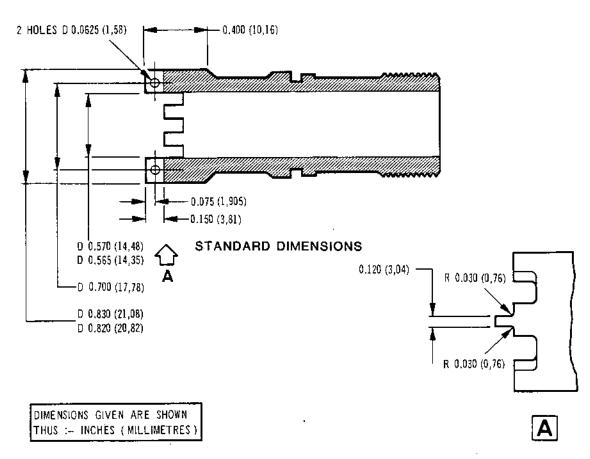
- (1) Either, or both lugs may be welded to this repair scheme at any one repair.
- (2) Ensure that no damage occurs to the nipple end or the tube.



NOTE:- TUBE OMITTED FOR CLARITY



WELD BUILD-UP DETAIL



Nut Wire Locking Lugs Rework Details Figure 401

REPAIR

72-53-00 Repair No.5 Page 402 Jun 1/83



3. Instructions

A. Procedure

- (1) Prepare the lug(s) for welding.
 - (a) Clean the lug(s) to be welded using clean, fine Scotchbrite and vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 -Cleaning).
 - (b) Place a copper shim between the lug and the tube to guard the tube when welding.
- (2) Inert gas weld lug(s).
 - (a) Build up the lug(s) using hand held argon inert gas welding and filler rods to MS.9500/2 (Ref.Fig.401).
- (3) Heat Treat.
 - (a) Heat treat welded location 550 deg.C for 1 hour in air. Cool in air.
- (4) Inspect.
 - (a) Inspect welded location using process specified in TSD594 Op.210.
- (5) Dress the lug(s).
 - (a) Dress to produce the dimensions shown in Figure 401.
 - (b) Drill the 0.0625 1n. (1,58 mm) diameter hole(s).
- (6) Inspect.
 - (a) Inspect to ensure the satisfactory completion of para. (3).
- (7) Inspect.
 - (a) Inspect the lug(s) using the process specified in T.S.D.594 OP.210.



- (8) Identify Repair.
 - (a) Mark 'SAL.B.493748' or 'R 5' adjacent to assembly number using electro-chemical marking or vibro-percussion engraving (Ref.72-09-00 Repair).
- (9) Final Inspection.
 - (a) Finally inspect the tube assembly to ensure that the repair has been carried out satisfactorily and that the assembly is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.

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Repair No.5
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SEAL HOUSING ASSEMBLY BLENDING OF DAMAGE TO SEAL BUSH

MODIFICATION NO. OL. 8849C

1. Effectivity

| I_P.C. | Fig./Item | <u>Part No.</u> |
|----------|-----------|-----------------|
| 72-53-00 | 1 340 A | B471802 |
| | 340B | B496169 |
| | 2 40 A | B471805 |
| | 40B | 8496170 |

2. Introduction

A. General

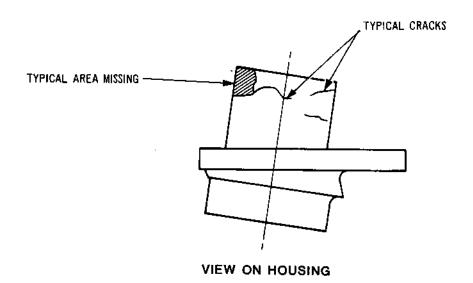
- (1) This repair describes the procedure for blending damage to the seal housing assembly.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
 - (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
 - (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
 - (8) All tools referred to by item number in procedural steps are detailed in para.4.
 - (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

B. Repair Limitations.

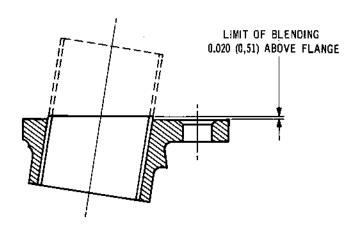
(1) Maximum removal of material during blending must not exceed the limit shown in Fig. 401.

> REPAIR 72-53-00 Repair No.6 Page 401 Mar 1/84





DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)



SECTION THROUGH HOUSING

Blending Details Figure 401

> 72-53-00 Repair No.6 Page 402 Mar 1/84



3. Instructions

- A. Blend Damage.
 - (1) Blend the damaged or cracked portion of the seal bush, as necessary, within the repair limitations (Ref. Fig. 401).
- B. Inspect.
 - (1) Crack test the seal housing assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-53-00 Inspection/Check.
- C. Identify.
 - (1) Mark SAL. B935549 or R6 adjacent to the existing part number, using electro-chemical marking, vibropercussion engraving or acid etching technique detailed in Chapter 72-09-00 Repair.
- D. Final Inspection.
 - (1) Finally inspect the seal housing assembly to ensure that the repair has been carried out satisfactorily, and that the seal housing assembly is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.



TUBE, ASSEMBLY OF

REPAIR OF DAMAGE TO SPHERICAL SLEEVE LOCATION DIAMETER BY WELDING.

REPAIR NO. B506313

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|-----------|------------------------------------|
| 72-53-00 | 1 A 330F | B496181 B497135 B497136 B497137 |
| | | B497138 B497139 |
| | 1 A 330G | B500424 B500425 B500426 B500427 |
| | | B500428 B500429 |
| | 2 30 F | B496185 B496142 |
| | | B496143 B496144 |
| | | B496145 B496146 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Maximum depth of repairable damage 0.030 (0,76).

This repair may be embodied any number of times provided dimensional requirements are maintained (refer fig. 403 and 404).

Welding is permitted on the spherical sleeve only and must not encroach within any other area of the Tube, assembly of (refer fig.402).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR

72-53-00 Repair No. 7 Page 401 Jun 1/92



| 4 | REPAIR PROCEDURE | SUPPLEMENTARY INFORMATION |
|-----|--|--|
| 1) | Prepare fretted/damaged area(s) for welding. | Refer TSD 594 OP.409 Refer fig.402. |
| 2) | Locally crack detect repair area(s). | Refer Overhaul Manual Chapter 72-53-00 Inspection/Check |
| 3) | Degrease area(s) to be welded. | Refer TSD 594 OP.101 |
| 4) | Pre-heat Tube assembly to 200°C. | Refer TSD 594 OP.409 |
| 5) | Build up fretted/damaged area(s) by inert gas arc welding. Apply sufficient weld metal to restore outer diameter of spherical sleeve location. | Refer TSD 594 OP.409 Use filler rods OMat 311 (Stellite 12). |
| 6). | Locally crack detect repair area(s). | Refer Overhaul Manual Chapter 72~53-00 Inspection/Check. |
| 7) | Finish machine to restore spherical sleeve dimensions. | Refer fig.401 and 403. |
| 8) | If weld metal has encroached into the identification flat on the spherical sleeve, re-machine flat to restore dimensions. | Refer Fig.404. |
| | NOTE: This operation, where required, is applicable to SB. OL.593-72-8790-306 standard Tube, assembly of's only. | |
| 9) | Lightly polish spherical sleeve to remove discolouration. Use fine grade abrasive matt. | Refer OMat 583. |
| 10) | Crack detect. | Refer Overhaul Manual Chapter 72-53-00 Inspection/Check. |
| | | |

REPAIR
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11) Visually inspect on completion of repair.

Refer TSD 594 OP.409

12) Visually inspect condition of braze joint around edge of spherical sleeve at position AC. Braze filler must be intact and continuous around complete circumference of joint. Refer TSD 594 OP.404 Refer fig.403.

13) Vapour degrease Tube, assembly

Refer TSD 594 0P.101

- 14) Re-lubricate threads using engine oil.
- 15) Fit blanks (as required).
- 16) Mark Repair Instruction number RI B506313 or R7 adjacent to normal 'assy. of' no.
 Use electro-chemical marking (where 'assy. of' no. is marked on tube run) or vibro-percussion engraving (where 'assy. of' no. is marked on a fitting).

Refer Overhaul Manual Chapter 72-09-00 Repair Refer fig.401.

5. MATERIAL

COMPONENT MATERIAL RR CODE

Tube Stainless Steel EBS
MSRR 6524

Spherical sleeve Nimonic alloy QCE

Spherical sleeve Nimonic alloy QCE MSRR 7076

6. DATA

None.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION

ITEM

None.

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8. REPLACEMENT PARTS

PART NUMBER

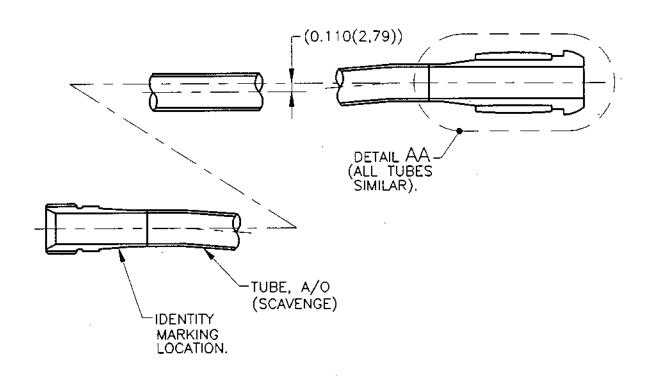
DESCRIPTION

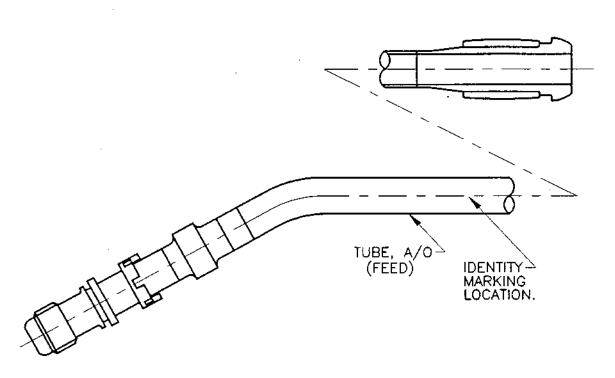
QUANTITY

ITEM

None.

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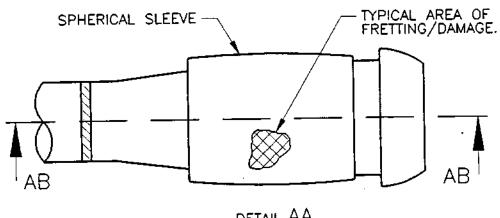


TYPICAL VIEW - TUBE, ASSEMBLY OF FIG.401

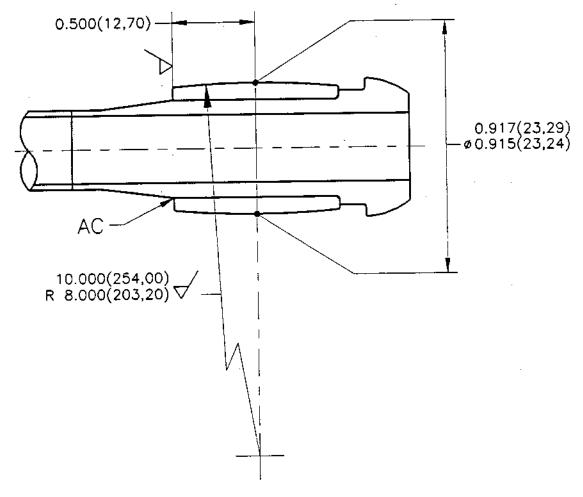
REPAIR

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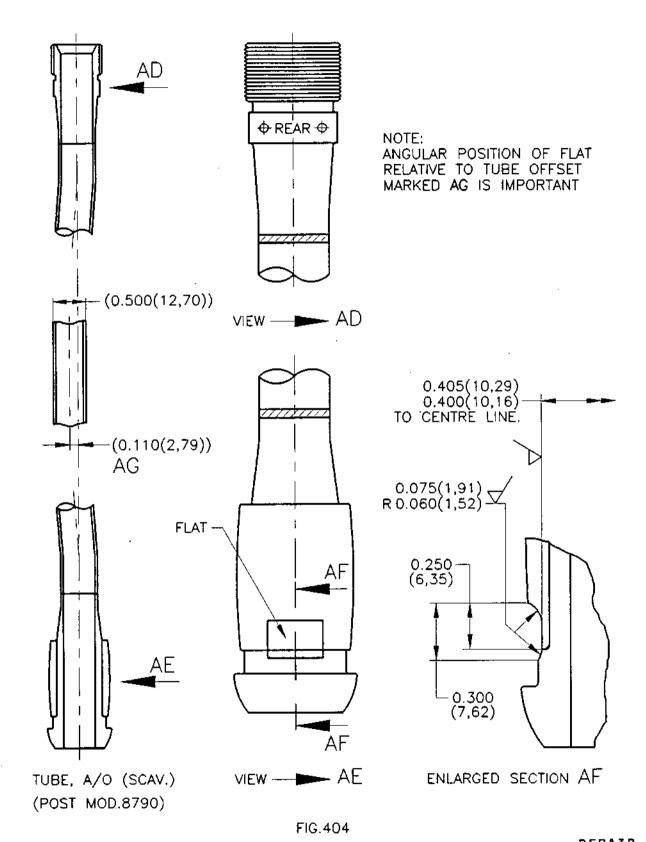


DETAIL AA FIG.402



SECTION AB

REPAIR 72-53-00 Repair No. 7 Page 406 Jun 1/92



REPAIR 72-53-00 Repair No. 7 Page 407 Jun 1/92



TURBINE EXHAUST DIFFUSER ASSEMBLY - COLD VENT TUBE REPAIRED BY REPLACING THE LOCATING SLEEVE

MODIFICATION No. OL. 8886C

1. Effectivity

| I.P.C. | Fig./Item | <u>Part No.</u> |
|----------|-----------|----------------------------------|
| 72-53-00 | 1 420 | 8.496177 8.496192 8.497085 |

2. Introduction

A. General

- (1) This repair describes the procedure for removing the existing sleeve and brazing on a new sleeve.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0.25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

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3. <u>Instructions</u>

- A. Machine Tube Assembly.
 - (1) Locate the tube assembly to a lathe, and set true.
 - (2) Remove the existing sleeve by machining to 0.560/0.558 in. (14,22/14,17 mm) diameter (Ref.Fig.401).
 - (3) Remove burrs, sharp edges and any remnants of braze.

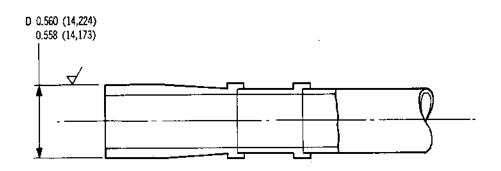
B. Inspect.

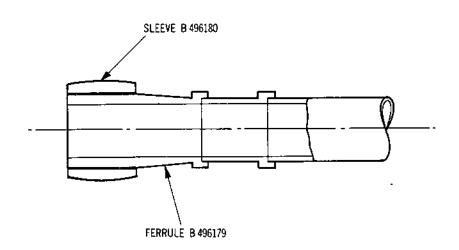
- (1) Inspect the tube assembly for the satisfactory completion of the machining operation.
- (2) Crack test the tube assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-53-00 Inspection/Check or TSD594 0P213.
- (3) Check the diametric clearance of the ferrule and the new sleeve B496180 (Ref.Fig.401).

C. Braze Sleeve.

- NOTE: Ensure that the tube assembly and the sleeve are not contaminated between degreasing and brazing operations.
- (1) Vapour degrease the tube assembly and the new sleeve 8496180. For procedure, refer to Chapter 72-09-00 Cleaning or TSD594 OP101.
- (2) Locate the sleeve on the ferrule, and retain with four equally spaced centre-punch marks on the ferrule surface. Ensure that the ends of the sleeve and the ferrule are flush.
- (3) Vacuum braze the sleeve to the ferrule using Microbraz 130 (0 Mat 3/118). For procedure, refer to TSD594 0P416.

CR 36124/00A





DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Cold Vent Tube Assembly Sleeve Figure 401

> 72-53-00 Repair No.8 Page 403 Jun 1/88





- D. Inspect.
 - (1) Visually inspect the integrity of the brazed joint, as instructed in TSD594 OP416.
 - (2) Crack test the tube assembly using the fluorescent dye penetrant process specified for this component in Chapter 72-53-00 Inspection/Check or TSD594 0P213.
- E. Identify.
 - (1) Mark SAL B.507100 or R8 adjacent to the existing part number using electro-chemical or vibro-percussion marking as instructed in 72-09-00 Repair.
- F. Final Inspection.
 - (1) Finally inspect the tube assembly to ensure that the repair has been carried out satisfactorily, and that the tube assembly is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None

Replacement Parts

| <u>Description</u> | Quantity | <u>Part No.</u> | IPC | <u>Fig./Item</u> |
|--------------------|----------|-----------------|----------|------------------|
| Sleeve | 1 | в4 96 180 | 72-53-00 | 1/ — |



TURBINE EXHAUST DIFFUSER ASSEMBLY - REPAIR FRETTING OF OUTER CASE REMOVED BY BLENDING

MODIFICATION NO. OL.8941C

1. Effectivity

| I.P.C. | <u>Fig./Item</u> | <u>Part No.</u> | |
|----------|------------------|---|--|
| 72-53-00 | 4 230 | B922156, B922157, B922477, B922484, B923924, B923925, B926609, B926610, B926612, B926613, B927106, B927107, B927138 | |

2. Introduction

A. General.

- (1) This repair describes the procedure for blending fretting damage at the vane end bosses on the turbine exhaust diffuser outer case.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

72-53-00 Repair No.9 Page 401 Jun 1/90



- B. Repair Limitations (Ref.Fig.401).
 - (1) Minimum wall thickness:

NOTE: Wall thickness given below are measured circumferentially at the plane lines. To obtain minimum limits between planes of different thickness, it is necessary to interpolate.

| (a) | Rear of section | change line | | | |
|-----|-----------------|-------------|-----------|-------|-----|
| | (rear of AB) | _ | 0.068 in. | (1,73 | mm) |

| (b) Plane AB 0.0 | 186 | in. 🔻 | (2,18 | mm) |
|------------------|-----|-------|-------|-----|
|------------------|-----|-------|-------|-----|

| (c) Planes AC, AD, AE 0.067 in. | (1.70 mm) |
|---------------------------------|------------|
|---------------------------------|------------|

| (d) Plane AF | 0.106 in. | (2,69 mm) |
|--------------|-----------|-----------|
|--------------|-----------|-----------|

- (e) No blending is permissible forward of plane AF.
- (f) Wall thickness limits given in paragraphs (a) and (b) may be reduced to 0.056 in. <1,42 mm) provided that not more than two isolated areas at each blend location are affected and the areas do not exceed 0.394 in. (10 mm) square.
- (2) Maximum size of blended areas:

| (a) | Maximum | axial | blend | limit | 5.500 ir | ı. (139 | ,7 mm) |
|-----|---------|-------|-------|-------|----------|---------|--------|
|-----|---------|-------|-------|-------|----------|---------|--------|

(b) Maximum blend width 1.000 in. (25,4 mm)

(c) Minimum distance between blends 1.180 in. (29,97 mm)

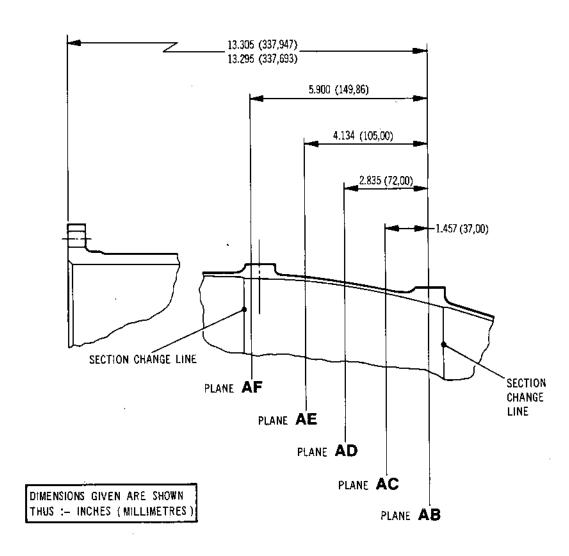
(3) Maximum number of blended locations

(4) For re-application of the repair, the total blend depth must not exceed the repair limitations.

3. <u>Instructions.</u>

- A. Blend Fretted Areas.
 - (1) Blend the fretted areas within the repair limitations using conventional hand tools. Grinding must not be used. Blends must be smooth and continuous with no sharp edges or corners.

72-53-00 Repair No.9 Page 402 Jun 1/90 CR 36272/00A



Turbine Exhaust Diffuser Case Blend Limits Figure 401

REPAIR 72-53-00 Repair No.9 Page 403 Jun 1/90



- B. Inspect.
 - (1) Inspect for cracks using the fluorescent dye pentrant process specified for this component in Chapter 72-53-00 Inspection/Check.
 - (2) Inspect to ensure that wall thicknesses and blended areas comply with repair limitations.
- C. Identify.
 - (1) Mark SAL B512728 adjacent to the existing part number using vibro-percussion marking as specified in Chapter 72-09-00 Repair.
- D. Final Inspection.
 - (1) Finally inspect to ensure that the repair has been carried out satisfactorily, and that the case is in a serviceable condition.
- 4. Special Tools, Fixtures and Equipment

None.

5. Replacement Parts

None.



HOUSING, SEAL RESTORATION OF HOUSING, SEAL BORE BY PLASMA SPRAY

REPAIR NO. B513674

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-53-00

01 090A

B466747

2. <u>REPAIR LIMITATIONS</u>

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Maximum repairable diameter to which the housing bore may be machined is governed by the minimum wall thickness which should not be less than 0.063(1,60) after machining to remove damage.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Mount component on a universal grinder and set true. Grind to remove chromium plating (or plasma spray coating) and damage completely to the dimensions shown.
- 2) Dimensionally inspect.

Refer fig. 401

Refer fig.401

72-53-00 Repair No. 10 Page 401 Jan 4/93



3) Etch to ensure previous coating has been completely removed from the bore. Refer TSD 594 OP 214.

4) Inspect for cracking.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

5) Mask areas not to be coated and plasma spray to sufficient thickness so that final dimensions are achievable.

Refer TSD 594 OP 704. Use MSRR 9507/43 (METCO 450P NS).

6) Inspect coating for integrity.

Refer TSD 594 OP 704 Section 8.

7) Set component on a suitable machine and set true. Machine bore to the dimensions shown.

Refer fig.401 and 402

8) Dimensionally inspect.

Refer fig.401

9) Visually inspect coating defects.

Refer ISD 594 OP 704 Section 8.

10) Mark SAL.B513674 or R10 and coating symbol HA adjacent to existing part number using vibro-percussion engraving.

Refer Overhaul Manual, 72-09-00, Repair.

5. MATERIAL

COMPONENT

MATERIAL

MSRR 6536

RR CODE

HOUSING, SEAL.

CORROSION RESISTANT STEEL

EDE

6. DATA

NONE

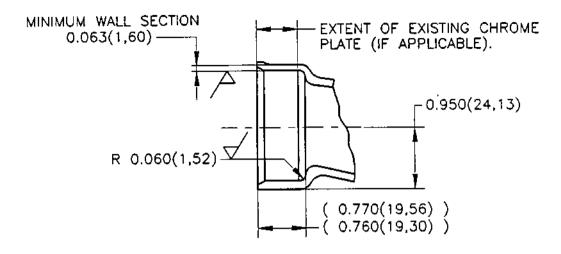
7. <u>TOOLS</u>

NONE

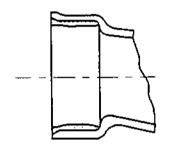
8. PARTS

NONE

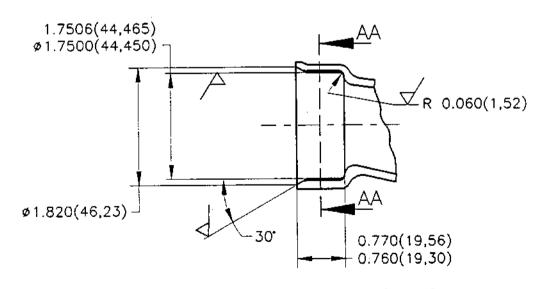
72-53-00 Repair No. 10 Page 402 Dec 1/91



VIEW SHOWING PRE-SPRAY MACHINING



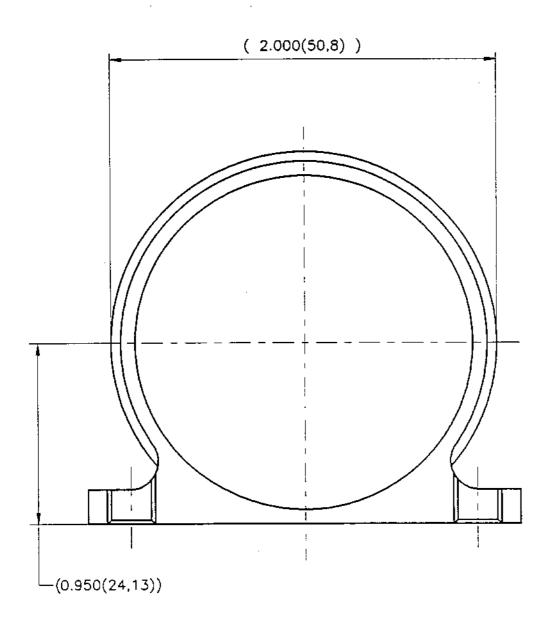
VIEW SHOWING PLASMA SPRAY COATING



VIEW SHOWING FINAL MACHINING FIG. 401

72-53-00 epair No. 10 Page 403 Dec 1/91





SECTION AA FIG.402

REPAIR

72-53-00 Repair No. 10 Page 404 Dec 1/91

DUCT, ASSY OF REPAIR OF CRACKS IN FLANGE OUTER AND/OR WELD JOINT OF FLANGE INNER

REPAIR NO. B513673

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-53-00

01A 060C

B490111

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process must be achieved without deviation. Where a need to deviate is considered necessary reference must be made to the Repair Authority for agreement.

A single crack 3.000 (75,0) long, or multiple cracks with a combined total length not exceeding 3.000 (75,0), may be repaired at each flange location.

3. GENERAL

UNLESS OTHERWISE SPECIFIED prawing practice & tolerance interpretation to ISO1101 (JES160) Dimensions in Inches (Millimeters) Tolerances on machined dimensions plus/minus .010 (0,25) Tolerance on angles plus/minus 2 degrees Break sharp edges .004 to .020 (0,1 to 0,5) Surface texture interpretation to ISO1302 (JES137) Surface texture to be 125 (3,2) Microinches (Micrometers) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Inspect to determine position and extent of damage.
- 2) Using conventional hand tools, groove for the complete length of crack(s).

72-53-00 Repair No. 11 Page 401 Dec 1/91 Crack detect to ensure that cracks have been identified. Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

4) Argon arc weld crack(s).

Refer TSD 594-409 Using filler rods to MSRR 9500/2. Group 1 welds

5) Using conventional hand tools, blend weld flush with existing profile and to the requirements shown. Do not impair parent material.

Refer fig.401, 402 and 403

6) Crack detect repaired areas.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

7) Radiologically inspect repaired areas.

Refer TSD 594-409

8) Dimensionally inspect.

Refer fig. 401, 402 and 403

9) Mark on SAL B513673 or R11 adjacent to existing part number, using vibro-engraving method.

Refer Overhaul Manual Chapter 72-09-00 Repair

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

DUCT, ASSY OF.

JETHETE MSRR 6523 EBM

6. DATA

NONE.

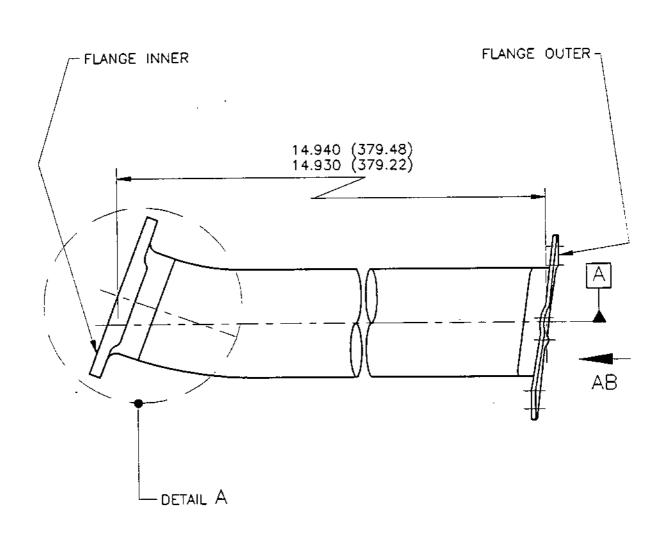
7. TOOLS

NONE.

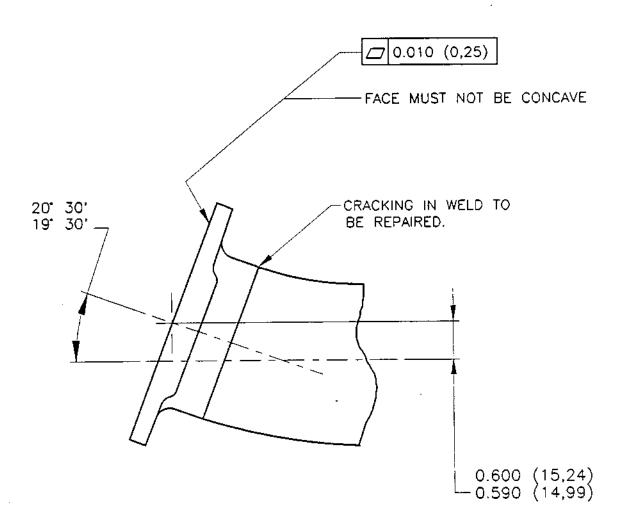
8. REPLACEMENT PARTS

NONE.

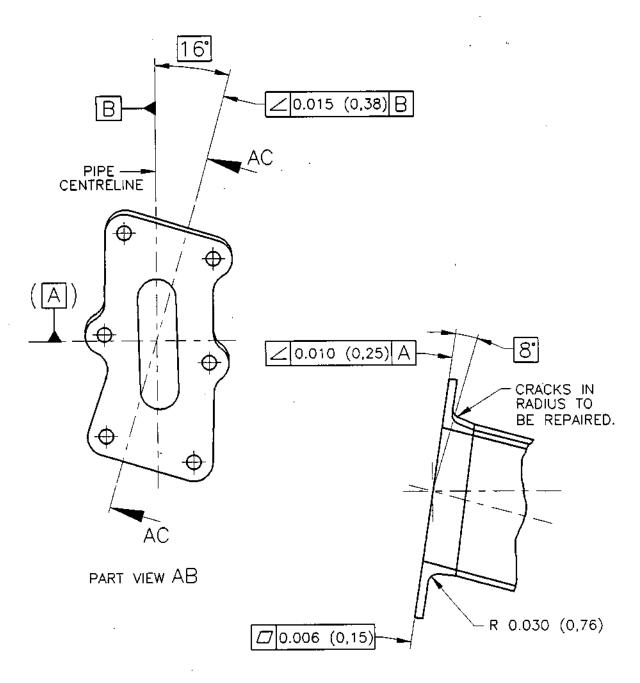
72-53-00 Repair No. 11 Page 402 Dec 1/91



GENERAL VIEW OF DUCT ASSY. FIG.401



DETAIL AT A FIG.402



SECTION AC

FIG.403



DIFFUSER, ASSY OF, INNER, TURBINE EXHAUST

REPAIR OF IMPACT DAMAGE AND/OR CRACKING BY BLENDING AND/OR WELDING

REPAIR NO. B514577-8

1. EFFECTIVITY

| IPC | Fig. | 'Item | Part No. |
|----------|------|-------|---|
| 72-53-00 | 9 | 40B | B925617 |
| | 9 | 40 C | B926879 B926892 B926895 B926896 B926900 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

IMPACT DAMAGE:

Smooth bottomed impact damage up to 0.020(0,51) deep is acceptable following blending and polishing to remove sharp edges/raised material.

Sharp bottomed impact damage and/or impacts in excess of 0.020(0,51) deep must be welded.

CRACKING IN INNER CONE:

Cracking in inner cone is acceptable for repair at all 10 vanes positions (Refer fig. 401).

Maximum length of crack acceptable for repair is 2.000(50,80).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR

72-53-00 Repair No. 12 Page 401 Dec 30/98



4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

A. IMPACT DAMAGE

1) If welding is required, remove items 1 to 9 (as applicable) from inner cone and/or rear flange. Use standard hand tools. Refer Para.8. REPLACEMENT PARTS.

2) Inspect flange rivet holes.

Refer fig.402

- 3) Blend and polish smooth bottomed impacts up to 0.020(0,51) deep to remove sharp edges/high metal.
- 4) Locally crack detect repaired areas.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

NB. Where no welding is required proceed to operation 12).

5) Prepare sharp bottomed impacts for welding.

Refer TSD 594 OP.409

Puddle weld prepared locations.

Refer TSD 594 OP.409
Use filler wire OMAT 3/62.

- 7) Locally dress repaired locations to restore original profile. Thinning of parent material not permissible.
- 8) Locally crack detect repaired areas.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

9) Heat treat component at 800°C + 10°C for 2 hours. Cool in air. Refer TSD 594 OP.409 Appendix 3.

10) Crack detect.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

11) Obtain parts items 1 to 2 or items 3 to 9 (as applicable) and secure to inner cone and/ or rear flange (as applicable). Refer Para 8. A to C. REPLACEMENT PARTS. Use standard hand tools. Refer fig.402

> REPAIR 72-53-00 Repair No. 12 Page 402 Jun 1/92

....

12) Mark Repair Instruction no.
RI B514577 or R12A on component
adjacent to normal 'assembly of'
number using the vibro-percussion
engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

B. CRACKING OF INNER CONE

 Remove items 1 to 9 (as applicable) from inner cone and/or rear flange. Use standard hand tools. Refer Para.8. REPLACEMENT PARTS.

2) Inspect flange rivet holes.

Refer fig.402

3) Vee groove for full extent of crack(s) and prepare for welding. Refer TSD.594 OP.409

4) Weld repair crack(s) as required.

Refer TSD 594 OP.409
Use filler wire OMAT 3/62.

5) Locally crack detect repaired areas.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

6) Radiographically inspect repair area for defects. Refer TSD 594 OP.409

7) Heat treat component at 800° C $\pm 10^{\circ}$ C for 2 hours. Cool in air.

Refer TSD 594 OP.409

8) Crack detect.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

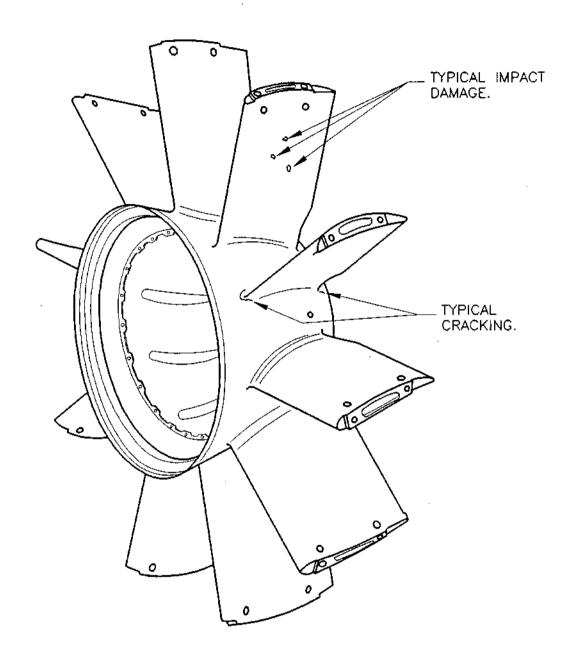
9) Obtain parts items 1 to 2 or items 3 to 9 (as applicable) and secure to inner cone and/ or rear flange (as applicable). Refer Para 8. A to C. REPLACEMENT PARTS Use standard hand tools. Refer fig.402

10) Mark Repair Instruction no.
RI B514578 or R12B on component
adjacent to normal 'assembly of'
number using the vibro-percussion
engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.



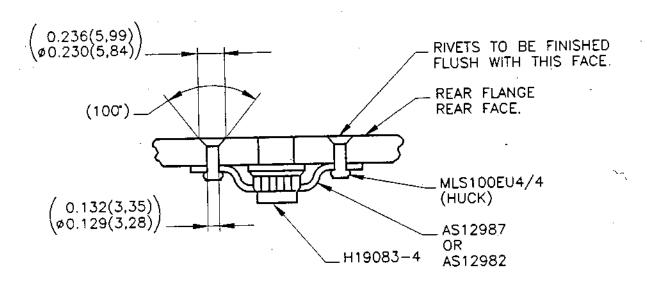
| 5. | MATERIAL | | | | |
|----|---|----------------|-----------------------------------|----------------|-------------|
| | COMPONENT | | MATERIAL | | RR CODE |
| | DIFFUSER, ASSY OF, INNER, TURBINE EXH | AUST | C263 MSRR 7035 | | QAH |
| 6. | DATA | | | | |
| | NONE | | | - | |
| 7. | TOOLS | | | | |
| | TÖOL NUMBER | DESC | RIPTION | | ITEM |
| | NONE | | | | |
| 8. | REPLACEMENT PARTS | | | | |
| | PART NUMBER | DESCRI | PTION | QUANTITY | ITEM |
| Α. | PRE-S.B. OL.593-72 | <u> -8038-</u> | 181 STD. (PO | OST OL.593-72- | 31 STD.) |
| | MLS100EU4/4 AS 12987 OR AS 12982 | | (HUCK) ER, NUT | 16 8 | 1 2 |
| В. | S.B. OL.593-72-803 | 8-181 | STD. | | |
| | MLS100EU4/5 OR | | (HUCK) | 16 | 3 |
| | 21217 TC 3212 H19083-4 B485200 B487391 | NUT BOLT, | (SOLID) MACHINE PLATE | 8 8 8 | 4 5 6 |
| с. | PRE-0L.593-72-31 | STD. | | | |
| | AS20625 AS12944 B413586 | WASHER | ELF LOCKING , FLAT BLANKING | 5 5 5 | 7 8 9 |



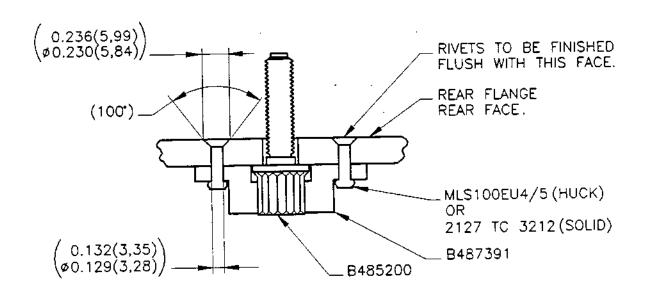
GENERAL VIEW OF DIFFUSER, ASSY OF, INNER, TURBINE EXHAUST FIG.401

REPAIR 72-53-00 Repair No. 12 Page 405 Jun 1/92





PRE-SB. OLY 593-72-8038-181 STD.



SB. OLY 593-72-8038-181 STD.

FIG.402

REPAIR 72-53-00 Repair No. 12 Page 406 Jun 1/92



TUBE, ASSEMBLY OF

REPAIR OF DAMAGE TO SPHERICAL SLEEVE LOCATION DIAMETER BY WELDING

REPAIR NO. B515008

1. EFFECTIVITY

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Maximum depth of repairable damage 0.030 (0,76).

This repair may be embodied any number of times provided dimensional requirements are maintained (refer fig. 403).

Welding is permitted on the spherical sleeve only and must not encroach within any other area of the Tube, assembly of (refer fig. 402).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Prepare fretted/damaged area(s) for welding.

Refer TSD 594 OP.409 Refer fig.402.

REPAIR

72-53-00 Repair No. 13 Page 401 Jan 4/93



| 2) | Locally | crack | detect | repair |
|----|----------|-------|--------|--------|
| | area(s). | , | | |

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check

Degrease area(s) to be welded.

Refer TSD 594 0P.101

4) Pre-heat Tube assembly to 200°C.

Refer TSD 594 0P.409

5) Build up prepared area(s) by inert gas arc welding.
Apply sufficient weld metal to restore outer diameter of spherical sleeve location.

Refer TSD 594 OP.409 Use filler rods OMat 311 (Stellite 12).

6) Locally crack detect repair area(s). Refer Overhaul Manual Chapter 72-53-00 Inspection/Check.

7) Finish machine to restore spherical sleeve dimensions. Refer fig.401 and 403.

8) Lightly polish spherical sleeve to remove discolouration. Use fine grade abrasive mat. Refer OMat 583.

9) Crack detect.

Refer Overhaul Manual Chapter 72-53-00 Inspection/Check.

10) Visually inspect on completion of repair.

Refer TSD 594 OP.409

11) Visually inspect condition of braze joint around edge of spherical sleeve at position AC. Braze filler must be intact and continuous around complete circumference of joint. Refer TSD 594 OP.404 Refer fig.403.

12) Vapour degrease Tube, assembly

Refer TSD 594 OP.101

- 13) Re-lubricate threads using engine oil.
- 14) Fit blanks (as required).

72-53-00 Repair No. 13 Page 402 Jan 4/93



15) Mark Repair Instruction number RI B515008 or R13 adjacent to normal 'assy of' no. using the the vibro-percussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair Refer fig.401.

5. MATERIAL

Tube

Stainless Steel EBS
MSRR 6524

Spherical sleeve Nimonic alloy QCE
MSRR 7076

6. DATA

None.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

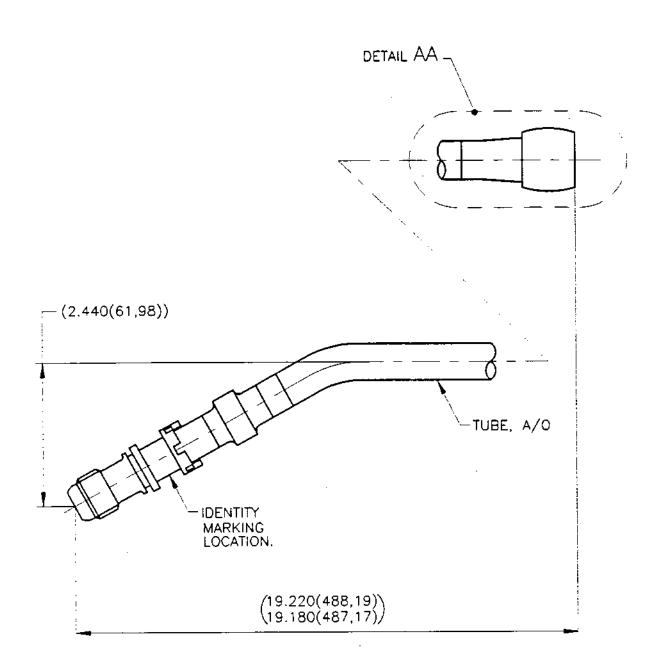
None.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

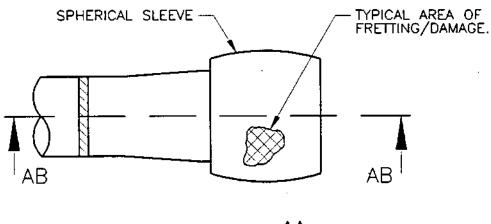
None.

72-53-00 Repair No. 13 Page 403 Jan 4/93

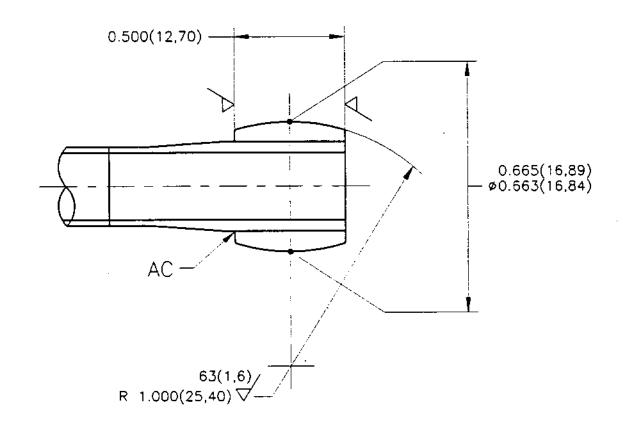


TYPICAL VIEW - TUBE, ASSEMBLY OF FIG.401

72-53-00 Repair No. 13 Page 404 Jan 4/93







SECTION AB FIG.403

REPAIR 2-53-00

Repair No. 13 Page 405 Jan 4/93



DUCT, ASSY OF.

REMOVE AND REPLACE DAMAGED END FITTING.

B516913

1. <u>EFFECTIVITY</u>

| <u>IPC</u> | Fig./Item | Part No. |
|------------|---|---|
| 72-53-00 | 1/60A 60B 1A/60C 1/230A 230B 1A/230C 2/130A 130B 130C | B437290 B487575 B490111 B437290 B487575 B490111 B437290 B487575 B490111 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Part through defective end fitting adjacent to weld line.
- Refer figs.401 and 403.
- 2) Hand dress back to weld centreline, allowing for weld shrinkage. Restore Duct outside diameter and ensure squareness to axis.

Refer fig.403.

REPAIR

72-53-00 Repair No. 14 Page 401 Jun 30/95



| 3) | Locally dye penetrant inspect repair area. | Refer TSD 594 OP.213 |
|----|---|-----------------------|
| 4) | Assemble replacement end fitting and inert gas arc weld | Refer para.8. Replace |

4) Assemble replacement end fitting and inert gas arc weld new end fitting to Duct assembly. Refer para.8. Replacement Parts, Item 1. Refer TSD 594 OP.409 Use filler wire OMat 306. Refer fig.404.

5) Dimensionally inspect.

Refer figs. 401, 402 and 404.

6) Radiographically inspect component.

Refer TSD 594 OP.409

7) Dye penetrant inspect component.

Refer TSD 594 OP.213

8) Hydraulic pressure test Duct Assembly with water at 20lbf/in (138kPa) for 1 minute.

9) Mark Repair Instruction number RI B516913 or R14 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Fig. 401.

5. MATERIAL

COMPONENT MATERIAL RR CODE

DUCT, ASSEMBLY OF. STAINLESS STEEL EBM
MSRR 6523

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

B437299 FLANGE OUTER 1 1

REPAIR 72-53-00 Repair No. 14 Page 402 Jun 30/95 14.940 (379.48)
14.930 (379.22)

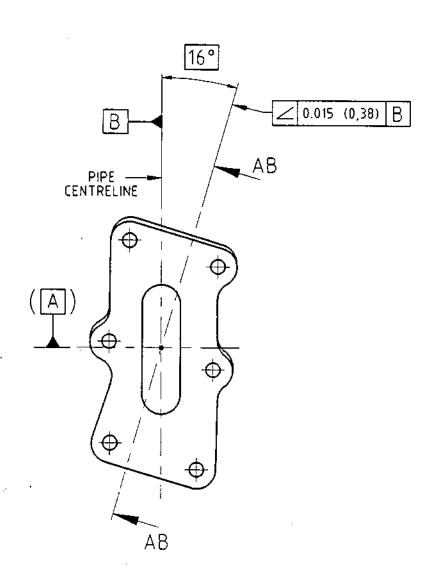
AA

IDENTITY MARKING
LOCATION

VIEW SHOWING DUCT ASSY OF, FIG.401.

72-53-00 Repair No. 14 Page 403 Jun 30/95

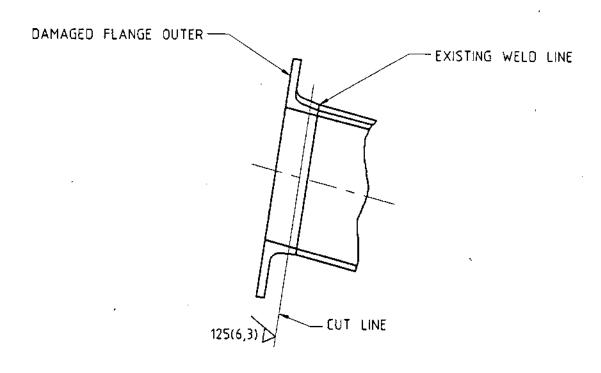


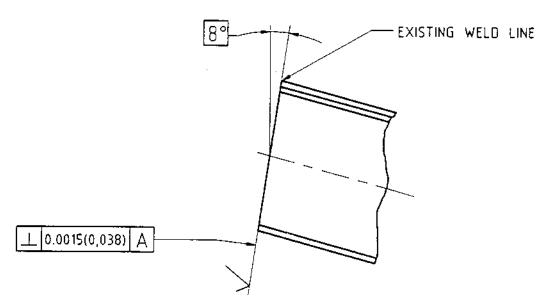


v → AA FIG.402.

> REPAIR 72-53-00 Repair No. 14 Page 404 Jun 30/95



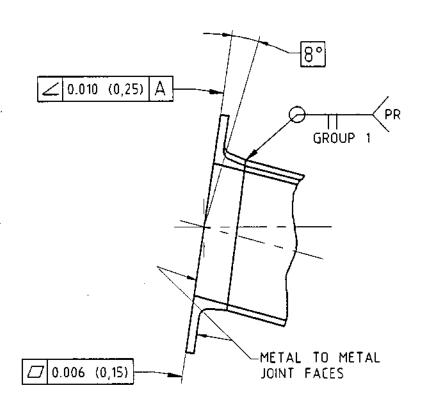




VIEW SHOWING CUTTING AND DRESSING REQUIREMENTS FOR REMOVING DAMAGED FLANGE OUTER FIG.403.

REPAIR 72-53-00 Repair No. 14 Page 405 Jun 30/95





SECTION AB FIG.404.

REPAIR 72-53-00 Repair No. 14 Page 406 Jun 30/95

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-505

Insert in 72-53-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

To introduce a repair scheme to replace worn bush P/No.B493783 in seal housing assembly P/No's.B471802 & 805. (MRA 52).

ACTION

- 1. Machine to remove bush (see Fig.A). To ensure complete removal of braze penetration, repair machining must be concentric with original bore.
- 2. Crack test using F1A process in accordance with Overhaul Manual.
- 3. Assemble bush to housing, as shown in Fig.b, and vacuum furnace braze bush in correct position using braze powder to B.S.1845 NI 4 i.e. Nicrobraze 130 or Endewrance CM.52.
 - N.B. Braze temperature range for N.130 is 1050° 1100° C. Braze temperature range for CM.52 is 1010° 1175° C. Braze in accordance with T.S.D.594-416.
- 4. Post heat treat at 800°C for 8 hours and cool in air.
- 5. Vibro engrave RST.4001 adjacent to part number.
- 6. Finally inspect.

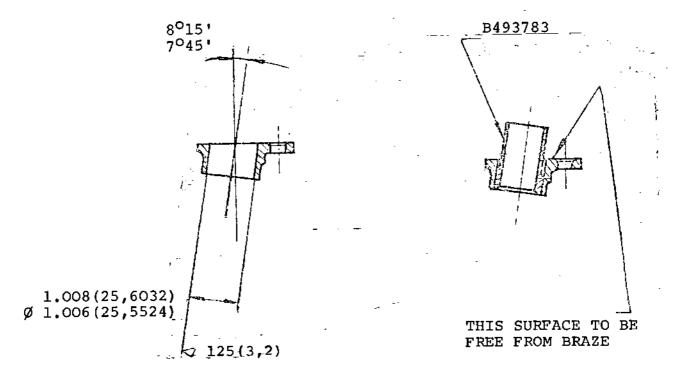


FIGURE a

FIGURE b

TR.72-505 72-53-00 TR Page 1 of 1

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-538

Insert in 72-53-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

To repair fretting and cracking on heat shield P/N B473860-63 (typical) (MRA 111)

ACTION

B.E.O.L. REPAIR

RST 4016 REPAIR BY DRESSING DIRECT WELDING OF SINGLE CRACKS AND PATCHING.

PROCEDURE:-

This Repair Scheme is in three Parts:

PART 1 covers minor edge defects up to .187" in length which may be blended.

PART 2 covers single cracks which may be direct welded.

PART 3 covers branch cracking and areas that will not produce under Part 1. This method of repair is by patching.

PART 1

- a) Blend out defect by forming a smoothly contoured scallop removing only the minimum amount of material necessary.
- b) Inspect for cracks. Refer to O.H.M. Vol. 3 Inspection/Check F.I.A. Process.

PART 2

- a) Clean thoroughly in preparation for welding. Remove gold paint locally from repair area refer to 0.H.M. Vol. 4 Section 72-09-03.
- b) Argon arc weld using filler rod to MSRR 9500/70 (Comm. Pure Titanium colour code: Orange, Yellow, Blue). Use argon 'bubble' atmosphere.
- c) Inspect for cracks. Refer to O.H.M. Vol. 3 Inspection/Check F.I.A. Process.
- d) Touch up Gold Paint + Refer to O.H.M. Vol. 4 Section 72-09-03.
- e) Finálly inspect.

Continued.

TR.72-538 72-53-00 RST 4016 TR.Page 1 of 2

TR.NO. 72-538 (cont'd)

PART 3

- a) Cut away defective area. MINIMUM corner radii 0.500".
- b) Prepare a flush fitting patch to suit area cut away at Opn.(a).

Patch Material - DTD 5023. Thickness before forming .025"/.019". Comm. Pure Titanium (MSRR 8608). i.e. Titanium 130 sheet and strip.

NOTE: Patch Material may be purchased as CU 59158 as per T.S.D. 594 - Op. 710.

- c) Clean both patch and patch location thoroughly in preparation for welding. Remove gold paint locally from repair area refer to O.H.M. Vol. 4 Section 72-09-03.
- d) Argon are weld patch on position using filler rod to MSRR 9500/ 70 (Comm. Pure Titanium colour code: Orange, Yellow, Blue). Use argon 'bubble' atmosphere.
- e) Inspect for cracks refer to OHM Vol. 3 Inspection/Check F.I.A: Process.
- f) Touch up Gold Paint refer to O.H.M. Vol. 4 Section 72-09-03.
- q) Finally inspect.
- h) The above is written per OLY/SEDP/1006 and DOI.T.7062.

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

Temporary Revision No. 72-549

Insert in 72-53-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

To introduce a repair for fretted bores in seal housing P/N B466747 (MRA 131).

ACTION

B.E.O.L. REPAIR

RST 4033 SEAL HOUSING:-FRETTED BORES

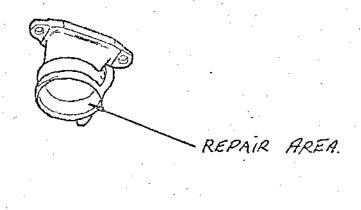
PROCEDURE

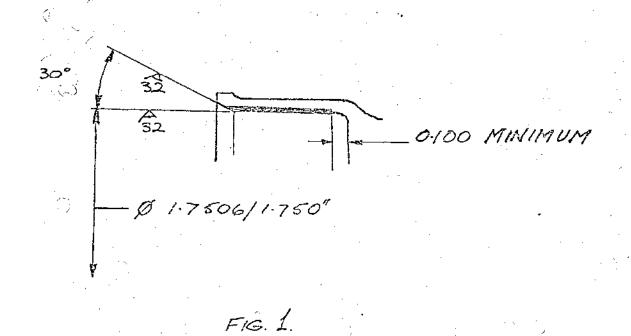
- 1. Strip chrome plate as per standard practices manual. Refer OHM Vol.4 72-0907 page 406 Para "D", if necessary.
- 2. If fret remains, machine bore to max. size, viz., 1.766" Dia. if necessary.

- 3. Chrome plate as per standard practices manual.
- 4. Grind bore to finished dimensions. See Fig. 1.
- 5. Heat treat to 140° 160°C for 1 hour. Cool in air.
- 6. Visually Inspect.
- 7. Dimensionally check.
- 8. Vibro engrave RST 4033 adjacent to P/N.
- 9. Above repair is in accordance with Oly/Sedp/968

British airways CONCORDE

TR.NO. 72-549 (cont'd)





TR-72-549 72-53-00 RST 4033 TR.Page 2 of 2

HOUSING, SEAL, ASSY OF-REMOVE AND REPLACE WORN BUSH (POST MOD. 72-8588 STD.) 8517938

1. <u>EFFECTIVITY</u>

| <u>Engine</u> | <u>Part Description</u> | Part No. | Classification |
|---------------|-------------------------|----------|----------------|
| Olympus | Housing Seat, | B496169 | Unclassified |
| | Assy of. | B496170 | Unclassified |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This instruction gives the procedure to remove and replace worn Bush in the Housing Seal, Assy of (Post Mod. 72-8588 Std.).

Validation testing is not required for this Repair Instruction.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 (0,1) to 0.20 (0,5)
Machine where marked
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

All TASKS identified in this instruction are in the Engine Overhaul Processes Manual (TSD594-J)

REPAIR

/2-53-UU Repair No. 15 Page 401

Jun 1/99



4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

Α. Machine the Part

1) Install the part in a suitable machine and set true.

Refer Fig. 401

2) Machine the part to remove the worn Bush from the Housing Seal, Assy of. NOTE: To ensure complete removal of braze, repair machining must be concentric with original bore.

Use machining equipment. Refer to Fig. 401.

Remove burrs. В.

1) Remove burrs and sharp edges.

Use hand held tools Refer to Fig. 401.

С. Examine the Part.

> Do a dimensional inspection Refer to Fig. 401. of the part.

D. Penetrant Crack Test

1) Do a penetrant crack test on the repair area.

Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-002. Use OMat 653 Fluorescent penetrant, medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

> REPÁIR Repair No. 15 Page 402 Jun 1/99



REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

Ē. Clean the Parts

Remove the grease from Housing Seal, Assy of and replacement Bush.

F. Braze the Part

1) Assemble Bush. Apply braze to area AB.

or TASK 70-00-00-100-102. Use degreasing equipment. Use Item 1 B517939 Bush, 1 off.

Refer to TASK 70-00-00-100-101.

Refer to TASK 70-00-00-300-416. Use OMat 3/118 High temperature brazing filler powder or alternative use OMat 3/118A High temperature brazing filler Powder.

Refer to Fig. 401 and 402.

2) Braze the part.

Refer to TASK 70-00-00-300-416. Braze between 1050 to 1100 Deg.C (1922 to 2012 Deg.F.) for 5 to 10 minutes. Use vacuum/argon atmosphere Furnace. Refer to Fig. 401 and 402.

Heat treat the Part.

1) Heat treat the part.

Heat to between 790 to 810 Deg.C. (1454 to 1490 Deg.F.) for 2 hours in an inert/vacuum atmosphere and rapid gas quench. Use inert/vacuum atmosphere furnace.

Η. Examine the Part

1) Do a visual inspection of the brazed joint (Bush/Housing Seal Assy of)

Refer to TASK 70-00-00-300-416. Refer to Fig. 401 and 402.

> REPÀIR Repair No. 15 Page 403 Jun 1/99



REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

J. Penetrant Crack Test

 Do a penetrant crack test on the part.

Refer to TASK 70-00-00-200-213 SUBTASK 70-00-00-230-213-001. Use OMat 653 Fluorescent penetrant, medium sensitivity. Cracks are not permitted. Use penetrant crack test equipment.

- K. <u>Identity the Repair</u>
- 1) Mark on B517938 or R15 adjacent to the part number.

Refer to Overhaul Manual Chapter 72-09-000 Repair. Use vibration peen equipment.

5. MATERIAL

| <u>MATERIAL</u> | RR CODE |
|------------------------------------|------------------------------------|
| Nomonic Alloy C263T (MSRR 7035) | QYS |
| Stellite 12 | QCE |
| | Nomonic Alloy C263T (MSRR 7035) |

6. DATA

NONE

7. TOOLS

NONE

8. REPLACEMENT PARTS

| PART NUMBER | <u>DESCRIPTION</u> | QUANTITY | <u>ITEM</u> |
|-------------|--------------------|-----------------|-------------|
| B517939 | Bush | 1 | 1 |

REPAIR 72-53-00 Repair No. 15 Page 404 Jun 1/99



9. STANDARD EQUIPMENT

Degreasing equipment
Hand held tools
Heat treatment equipment
Penetrant crack test equipment
Vacuum/Argon atmosphere furnace
Vibration peen equipment

10. CONSUMABLE MATERIAL

OMat 3/118 High temperature brazing filler powder
OMat 3/118A High temperature brazing filler powder
OMat 653 Fluorescent penetrant, medium sensitivity

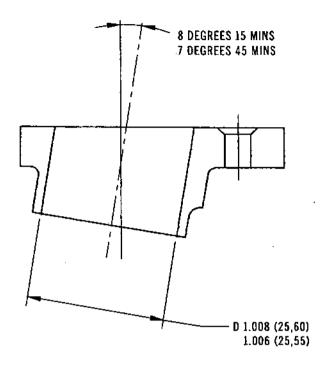
NOTE: 1. To identify the consumable materials refer to the Overhaul Material Manual (OMAT).

 Other necessary consumable materials are referred to in the Engine Overhaul Processes Manual. (SD594-J).

11. EXPENDABLE PARTS

NONE

REPAIR 72-53-00 Repair No. 15 Page 405 Jun 1/99



SECTION AA

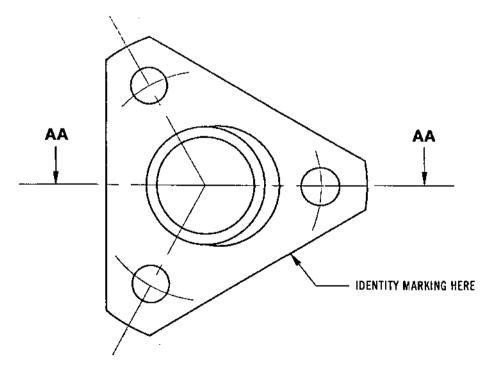
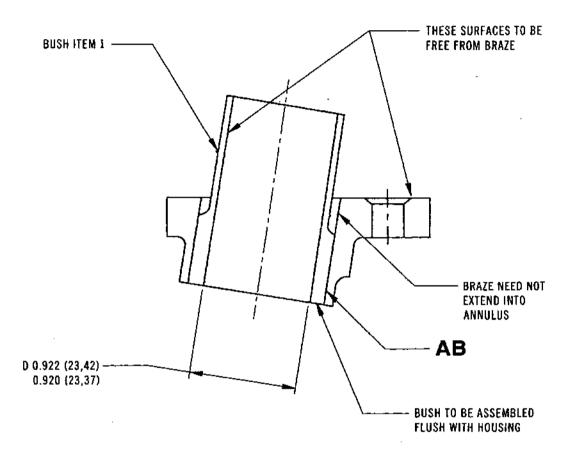


Fig. 401

REPAIR 72-53-00 Repair No. 15 Page 406 Jun 1/99 BS00025338/1



REPEAT SECTION AA SHOWING BUSH BRAZED IN POSITION

VACUUM BRAZE AT AB

Fig. 402

72-53-00 Repair No. 15 Page 407 Jun 1/99

British airways

OLYMPUS 593 OVERHAUL MANUAL

SPHERICAL JOINT FLANGE - REPAIR

TABLE OF CONTENTS

| Repair No. | Title |
|---------------------|---|
| 6-10 | FRONT FUEL DRAIN PIPE |
| 6-10-1 | Reshaping the sump of the pipe |
| 6-10-2 | Filler weld repair of cracks |
| 6-150 | SEAL COVER |
| 6-150-1 | Reshaping assembled seal cover |
| 6-150-2 | Filler welding of cracks in the seal cover assembly |
| [6-150A-3] | Renewal of the mounting brackets or the rivets |
| 6-150B-3) | which fix the brackets to the seal cover |
| (6-150A-4) | Reconditioning seal cover through patching |
| (<u>6</u> -150B-4) | |
| 6-150-5 | Repair worn rivet holes in seal cover BA |
| 6-180 | SPHERICAL JOINT FLANGE |
| 6-180-1 | Filler welding of cracks |
| 6-180-2 | Renewal of rivets or of defective riveted parts |
| 6-180-3 | Renewal of the bushes in riveted bosses |
| 6-180-4 | Removal of bosses provided for pressure tapping |
| 6-180-5 | Reconditioning the rear flange inner contact surface through metal spraying (metallizing) |
| 6-180-6 | Reconditioning tapped holes in bosses through bush installation |
| 6-180-7 | Reshaping the rear flange |



FRONT FUEL DRAIN PIPE (6-10)

1. Reshaping the sump of the pipe

| PARTS | REQUIRED | FOR | REPAIR | |
|-------|----------|-----|--------|--|
| | | | | |

A. Reshaping

(1) Reshape using a mallet, at ambient temperature and ensuring that the deformed section corresponds with the adjacent profile.

B. Soundness inspection

(1) Carry out a crack-test of the drain pipe assembly using water-washable fluorescent dye penetrant as per method M 502 B of chapter 70-20-10.

If a crack is found, repair it by filler welding following the instructions in repair scheme REP 6-10-2.

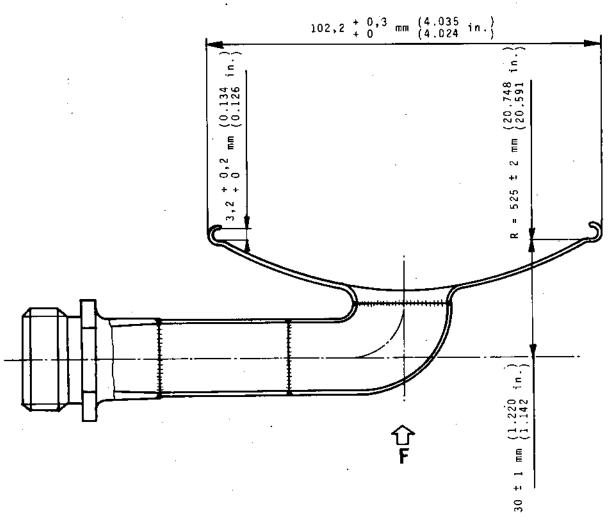
C. Dimensional inspection

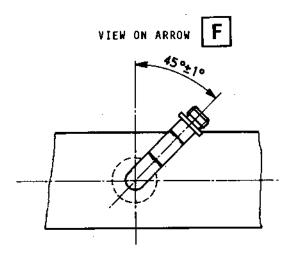
(1) Check the dimensions of the fuel drain pipe as shown on fig.401.

72-54-01 REP 6-10-1

Page 401 Dec 30/74







Reshaping Front Fuel Drain Pipe Figure 401

72-54-01 REP 6-10-1 Page 402 Dec 30/74



FRONT FUEL DRAIN PIPE (6-10)

2. Filler weld repair of cracks

PARTS REQUIRED FOR REPAIR

Weld filler wire P 3009.

- A. Welding of cracks
 - (1) Fill the cracks by argon arc welding as per instructions in chapter 70-35-10.
 - . Weld filler wire P 3009
 - . Weld class B2
- B. Soundness inspection
 - (1) Carry out an inspection of B2 class welds as per instructions in chapter 70-35-80.
 - . Crack test with water-washable fluorescent dye penetrant as per method M 502 B in chapter 70-20-10
 - . X-ray inspection of the welds as per chapter 70-20-30.

SEAL COVER (6-150)

1. Reshaping assembled seal cover

PARTS REQUIRED FOR REPAIR

A. Reshaping

Reshape the seal cover with a mallet so as to remove all local deformation.

B. Soundness inspection

Carry out an inspection of the reshaped area using water-washable fluorescent dye penetrant as per method M 502 B of chapter 70-20-10, to ensure the absence of cracks.

Should any cracks be found, filler-weld as per instructions of repair scheme REP 6-150-2.

72-54-01 REP 6-150-1

Pages 401/402 Jul 1/76

SEAL COVER (6-150)

2. Filler-welding of cracks in the seal-cover assembly

PARTS REQUIRED FOR REPAIR

Filler welding wire P 3020

A. Removing the mounting brackets

If necessary, remove the mounting brackets by grinding away the heads of the rivets.

B. Welding up the cracks

Filler weld the cracks as per the instruction in chapter 70-35-10.

- . filler welding wire P 3020
- . Weld class Bl
- C. Inspection of soundness

Carry out an inspection of class Bl welds as per instructions in chapter 70-35-80.

- inspection by water-washable fluorescent dye penetrant using method M 502 B of chapter 70-20-10.
- D. Re-assembly of mounting brackets.

Re-assemble the mounting brackets as per repair scheme REP 6-150-3.

REPAIR

72-54-01



SEAL COVER (6-150)

3. Renewal of the mounting brackets or the rivets which fix the brackets to the seal cover

PARTS REQUIRED FOR REPAIR

Rivets No. 650-772-025-0 or No. (awaiting definition). Load spreading washer No. 525-203-192-0 Mounting bracket No. 301-182-600-0

- A. Removal of damaged brackets
 - (1) Remove the damaged brackets by grinding away the heads of the fixing rivets.
 - (2) Inspect the rivet holes in the seal cover as per the instructions in chapter 70-50-10
 - (3) If necessary, re-drill the seal cover, the new brackets and the load spreading washers to an oversize diameter (see figure 401)
- B. Re-assembly of new brackets
 - (1) Assemble the new brackets using rivets selected as indicated in table I, as per instructions in figure 401 and chapter 70-50-10.
- C. Rivetting inspection
 - (1) Inspection of the rivetting as per instructions in chapter 70-50-80.

REPAIR

72-54-01

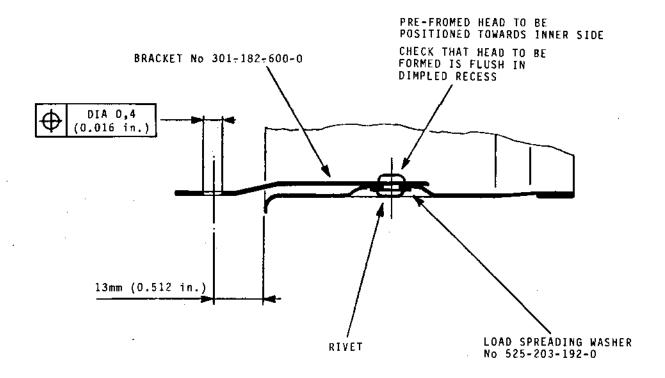


TABLE I - Rivet Data

| Standard rivet Repair rivet | Diameter mm (in.) | Length mm (in.) | Material | Head Shape |
|-----------------------------|----------------------|--------------------|----------|---------------|
| 650-772-025-0 | 4 (0.157) | 8 (0.315) | | Round Flat |
| 650-772-050-0 | 4,8 (0.189) | 9 (0.354) | | Round Flat |

Renewal of Mounting Brackets Figure 401

72-54-01 REP 6-150-3 Page 402 Jul 1/76



SEAL COVER (6-150 VARIANT A)

3. Renewal of the mounting brackets or the rivets which fix the brackets to the seal cover

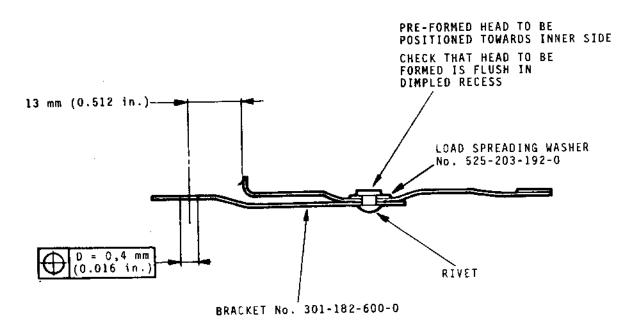
PARTS REQUIRED FOR REPAIR

Rivets No. 650-772-025-0 or No. 650-772-050-0 or No. 21215 TC 5611 (650-015-165-0) Load spreading washer No. 525-203-192-0 Mounting bracket No. 301-182-600-0

- A. Removal of damaged brackets
 - (1) Remove the damaged brackets by grinding away the heads of the fixing rivets.
 - (2) Inspect the rivet holes in the seal cover as per the instructions in chapter 70-50-10.
 - (3) If necessary, re-drill the seal cover, the new brackets and the load spreading washers to an oversize diameter (see figure 401).
- B. Re-assembly of new brackets
 - (1) Assemble the new brackets using rivets selected as indicated in table I, as per instructions in figure 401 and chapter 70-50-10.
- C. Rivetting inspection
 - (1) Inspection of the rivetting as per instructions in chapter 70-50-80.

REPAIR
72-54-01
REP 6-150A-3
Page 401
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RIVET DEFINITION TABLE

| RIVET No. | DIAMETER mm (in.) | LENGTH mm (in.) | MATERIAL | HEAD SHAPE |
|---------------|----------------------|--------------------|-----------|------------|
| 650-772-025-0 | 4 (0.157) | 8 (0.315) | NC 22 FeD | ROUND FLAT |
| 650-772-050-0 | 4,8 (0.189) | 9 (0.354) | NC 22 FeD | RGUND FLAT |
| 21215-TC5611 | 5,6 (0.220) | 11 (0.433) | NC 15 Fe | ROUND FLAT |

Renewal of Mounting Brackets Figure 401

REPAIR 72-54-01 REP 6-150A-3 Page 402 Sep 1/78



SEAL COVER (6-150 VARIANT B)

3. Renewal of the mounting brackets or the rivets which fix the brackets to the seal cover

PARTS REQUIRED FOR REPAIR

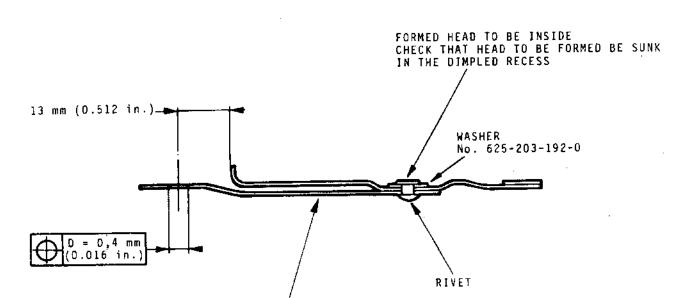
Rivets No. 650-772-025-0 or No. 650-772-050-0 or No. 21215 TC 5611 (650-015-165-0)

Load spreading washer No. 525-203-192-0

Mounting bracket No. 301-182-601-0

- A. Removal of damaged brackets
 - (1) Remove the damaged brackets by grinding away the heads of the fixing rivets.
 - (2) Inspect the rivet holes in the seal cover as per the instructions in chapter 70-50-10.
 - (3) If necessary, re-drill the seal cover, the new brackets and the load spreading washers to an oversize diameter (see figure 401).
- B. Re-assembly of new brackets
 - (1) Assemble the new brackets using rivets selected as indicated in table I, as per instructions in figure 401 and chapter 70-50-10.
- C. Rivetting inspection
 - (1) Inspection of the rivetting as per instructions in chapter 70-50-80.

REPAIR



BRACKET No. 301-182-601-0

RIVET DEFINITION TABLE

| RIVET No. | DIAMETER mm (in.) | LENGTH mm (in:) | MATERIAL | HEAD SHAPE |
|---------------|----------------------|--------------------|-----------|------------|
| 650-772-025-0 | 4 (0.157) | B (0.315) | NC 22 FeD | ROUND FLAT |
| 650-772-050-0 | 4,8 (0.189) | 9 (0.354) | NC 22 FeD | ROUND FLAT |
| 21215-705611 | 5,6 (0.220) | 11 (0.433) | NC 15 Fe | ROUND FLAT |

Renewal of Mounting Brackets Figure 401

REPAIR 72-54-01 REP 6-150B-3 Page 402 Sep 1/78



SEAL COVER (6-150 VARIANT A)

4. Reconditioning seal cover through patching

PARTS REQUIRED FOR REPAIR

Sheet metal P 3320 thickness 0,8 mm (0.031 in.) Rivet No. 650-772-025-0 Washer No. 525-203-192-0 Tab No. 301-182-600-0 Weld filler wire (P 3020)

A. Patch installation conditions

Patch installation conditions are described in chapter 70-35-10 "WELDING BY FUSION".

- B. Fabrication of patches
 - (1) Patch dimensions are in relation to deteriorations found. Their shapes must however meet the requirements of chapter 70-35-10 "WELDING BY FUSION".
 - (2) Patches must be cut out of sheet metal P 3320 thickness 0,8 mm (0.031 in.) or obtained from a sound area in a scrapped seal cover.
 - NOTE: In the case of a reinforced patch cut out of sheet metal, the reinforcement is welded on the patch prior to its installation by applying the instructions given in chapter 70-35-20 "RESISTANCE WELDING" and indications on figure 401.
 - Seam welding
 - Weld class : Bl
 - Weld inspection as described in chapter 70-35-80 "INSPECTION OF WELDS".
- C. Patch installation
 - (1) Argon arc weld the patches as per the instructions in chapter 70-35-10 "WELDING BY FUSION".
 - Weld filler wire P 3020
 - Weld class : B2
 - (2) Inspect welds class B2 as per chapter 70-35-80 "INSPECTION OF WELDS".
 - Dye penetrant inspection using water washable fluorescent penetrant process as per process M 502 B in chapter 70-20-10 "PENETRANT INSPECTION".

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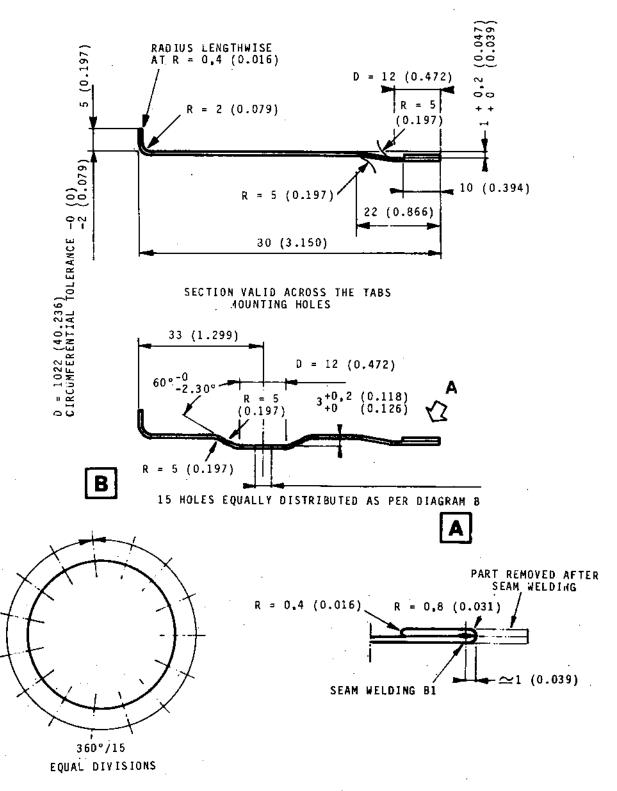


- X ray inspection as per chapter 70-20-30 "RADIOGRAPHIC INSPECTION".
- (3) Flatten the welds
- (4) Inspect welds for soundness using water washable fluorescent penetrant as per process # 502 B in chapter 70-20-10 "PENETRANT INSPECTION".
- (5) Should the patch be located in the vicinity of an attachment tab:
 - (a) Drill the seal cover as per the indications in figure 401.
 - (b) Rivet the tab as per the indications in figure 401 and the instructions in chapter 70-50-10 "STANDARD RIVETING".
 - (c) Inspect riveting as per the instructions in chapter 70-50-81 "INSPECTION OF RIVETING".
- (6) Carry out a dimensional inspection of the seal cover.

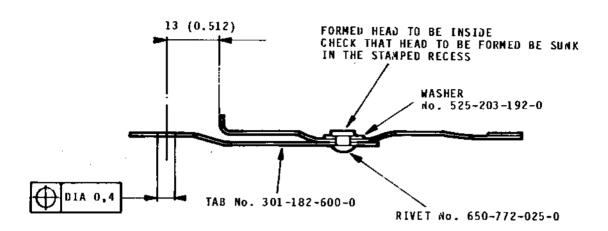
D. Marking

(1) Mark "REP 4" after the part number as per the instructions of process M 28 in chapter 70-10-10 "METHOD OF MARKING".





Reconditioning Seal-Cover Through Patching Figure 401 Sheet 1 of 2



RIVET DEFINITION TABLE

| Rivet No. | Diameter mm (in.) | Length mm (in.) | Material | Head shape |
|---------------|-------------------|--------------------|-----------|---------------|
| 650-772-025-0 | 4 (0.157) | 8 (0.135 | NC 22 FeD | Round flat |

Reconditioning Seal-Cover Through Patching Figure 401 Sheet 2 of 2

72-54-01

REP 6-150A-4 Page 404 Aug 1/77

SEAL COVER (6-150 VARIANT B)

Reconditioning seal cover through patching

PARTS REQUIRED FOR REPAIR

Sheet metal P 3320 thickness 0,8 mm (0.031 in.) Rivet No. 650-772-025-0 Washer No. 525-203-192-0 Tab No. 301-182-601-0 Weld filler wire (P 3020)

A. Patch installation conditions

Patch installation conditions are described in chapter 70-35-10 "WELDING BY FUSION".

- B. Fabrication of patches
 - (1) Patch dimensions are in relation to deterioration found. Their shapes must however meet the requirements of chapter 70-35-10 "WELDING BY FUSION".
 - (2) Patches must be cut out of sheet metal P 3320 thickness 0,8 mm (0.031 in.) or obtained from a sound area in a scrapped seal cover.
 - NOTE: In the case of a reinforced patch cut out of sheet metal the reinforcement is welded on the patch prior to its installation by applying the instructions given in chapter 70-35-20 "RESISTANCE WELDING" and indications on figure 401.
 - Seam welding
 - Weld class : Bl
 - Weld inspection as described in chapter 70-35-80 "INSPECTION OF WELDS".
- C. Patch installation
 - (1) Argon arc weld the patches as per the instructions in chapter 70-35-10 "WELDING BY FUSION".
 - Weld filler wire P 3020
 - Weld class : B2
 - (2) Inspect welds class B2 as per chapter 70-35-80 "INSPECTION OF WELDS"

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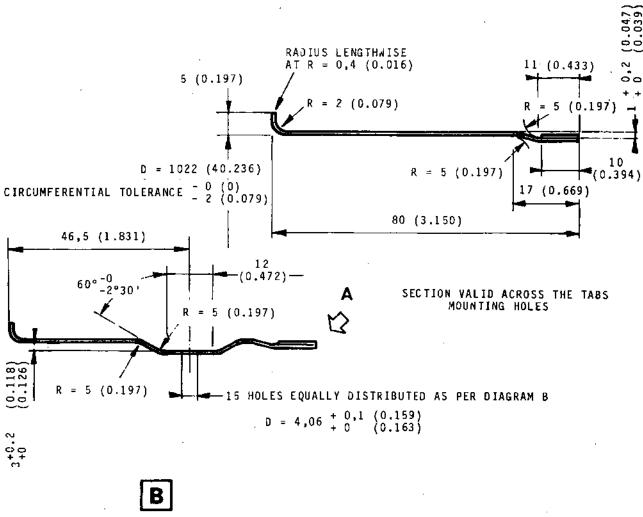


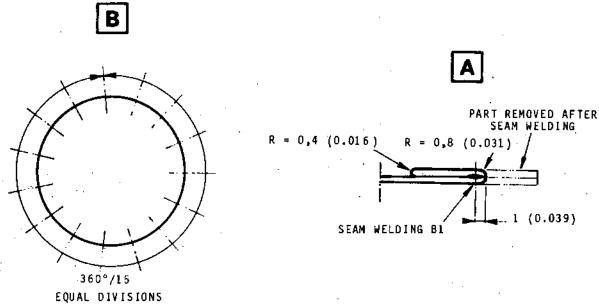
- Dye penetrant inspection using water washable fluorescent penetrant process as per process M 502 B in chapter 70-20-10 "PENETRANT INSPECTION".
- X ray inspection as per chapter 70-20-30 "RADIOGRAPHIC INSPECTION".
- (3) Flatten the welds
- (4) Inspect welds for soundness using water washable fluorescent penetrant as per process M 502 B in chapter 70-20-10 "PENETRANT INSPECTION".
- (5) Should the patch be located in the vicinity of an attachment tab:
 - (a) Drill the seal cover as per the indications in figure 401.
 - (b) Rivet the tab as per the indications in figure 401 and the instructions in chapter 70-50-10 "STANDARD RIVETING".
 - (c) Inspect riveting as per the instructions in chapter 70-50-81 "INSPECTION OF RIVETING".
- (6) Carry out a dimensional inspection of the seal cover.

D. Marking

(1) Mark "REP 4" after the part number as per the instructions of process M 28 in chapter 70-10-10 "METHOD OF MARKING".







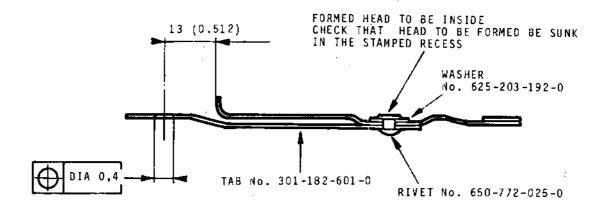
Reconditioning Seal-Cover Through Patching Figure 401 Sheet 1 of 2

72-54-01 REP 6-150B-4 Page 403

Aug 1/77







RIVET DEFINITION TABLE

| RIVET No | DIAMETER mm (in.) | LENGTH mm (in.) | MATERIAL | HEAD SHAPE |
|---------------|-------------------|-----------------|-----------|---------------|
| 650-772-025-0 | 4 (0.157) | 8 (0.315) | NC 22 FeD | Round flat |

Reconditioning Seal-Cover Through Patching Figure 401 Sheet 2 of 2

72-54-01

REP 6-150B-4 Page 404 Aug 1/77

ATP TEMPORARY REVISION

British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

This Temporary Revision complies with BCAR's Chapter A6-2 and TSS No.0-2

Denin Hardall

For Chief Technical and Industrial Services Engineer CAA Design Approval No.DAI/8566/78

TEMPORARY REVISION NO.72-571

Insert in 72-54-01 to follow Rep 6-150B-4 page 404

REASON FOR ISSUE

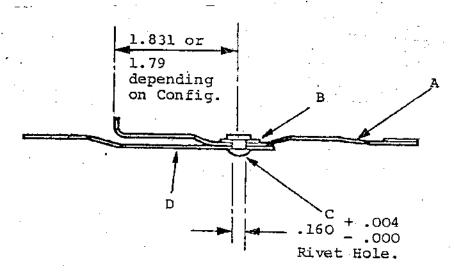
Repair worn rivet holes in seal cover

ACTION

SEAL COVER (6-150)

Repair worm rivet holes in seal cover.

- A. Remove rivet and tab D.
- B. Argon Arc plug weld worn hole in seal cover and attachment tab if necessary. Refer to O.H.M. 70-35-80 (welding process) use welding filler Rod KC 20 WN (BI type Inspection)
- C. Dress surplus weld, locate position and drill rivet hole.
- D. If crack is suspected at reworked area, Dye Penetrant crack inspect area.
- E. Fit tab with new rivets or Hi-lock fasteners IAW H.M.M.



- A Seal cover 301-182-500-0 (or 525-203-704-0)
- B Washer 525-203-192-0
- C Rivet 650-772-025-0 (Standard Size)
- D Attachment Tab 301-182-500-00

Figure 401

TR 72-571 72-54-01 TR Page 1 of 1

23 July 1981



SPHERICAL JOINT FLANGE (6-180)

Filler welding of cracks

PARTS REQUIRED FOR REPAIR

Weld filler wire P 3020

A: Welding of cracks

Argon arc filler weld the cracks as per instructions in chapter 70-35-10.

- filler welding wire P 3020
- weld class B2

B. Soundness inspection

Inspect the class B2 welds as per instructions in chapter 70-35-80.

- crack test with water washable fluorescent dye penetrant using method M 502 B given in chapter 70-20-10.
- x-ray inspection as per chapter 70-20-30.

72-54-01 REP 6-180-1

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SPHERICAL JOINT FLANGE (6-180)

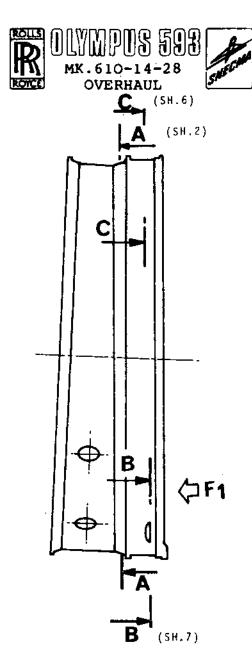
2. Renewal of rivets or of defective rivetted parts

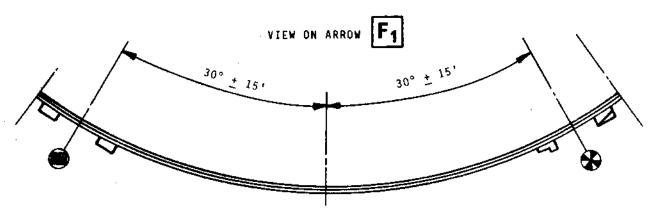
| PARTS REQUIRED FOR REPAIR | | | | | |
|---|---|--|--|--|--|
| Bracket Bracket Bracket Boss Boss Identification plate Rivet or Rivet or Rivet or Rivet or Rivet or Rivet | No. 301-171-300-0 No. 525-203-255-0 No. 525-203-263-0 No. 525-203-641-0 No. 301-170-501-0 No. 525-400-083-0 BNAE 21217TC3208 BNAE 21217TC4009 BNAE 21217TC4010 BNAE 21217TC4010 BNAE 21217TC4010 BNAE 21217TC4010 BNAE 21217TC4810 No. 650-025-106-0 BNAE 21217TC4814 BNAE 21217TC3212 | (650-025-074-0) (650-025-102-0) (650-025-075-0) (650-025-103-0) (650-025-102-0) (650-025-133-0) (650-025-137-0) (650-025-078-0) | | | |
| or Nut | No. 650-025-106-0 No. 649-784-338-0 | • | | | |
| or Nut Cage | No. 650-025-106-0 No. 649-784-338-0 No. 649-785-190-0 | | | | |
| Washer Washer | No. 649-786-532-0 No. 649-786-533-0 | | | | |

- A. Renewal of rivets or of defective rivetted parts
 - (1) Remove the rivets as per instructions in chapter 70-50-10.
 - (2) Re-assemble with new rivets selected as indicated in Table I and, if necessary, other new parts. See figure 401 and chapter 70-50-10 for re-assembly instructions.
- B. Rivetting inspection

Inspect rivetting as per figure 401 and chapter 70-50-80.

72-54-01



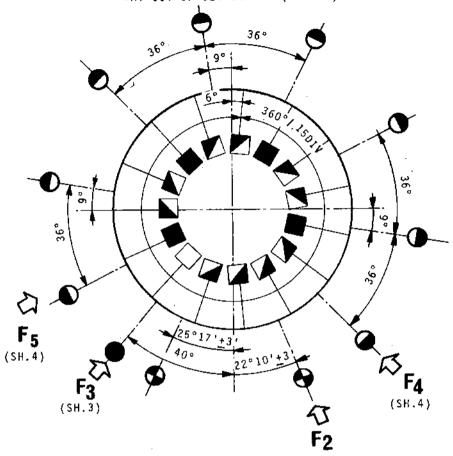


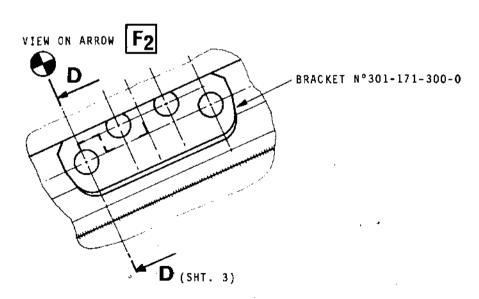
Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 1 of 8

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LAY-OUT OF SECTION A (SHT. 1)

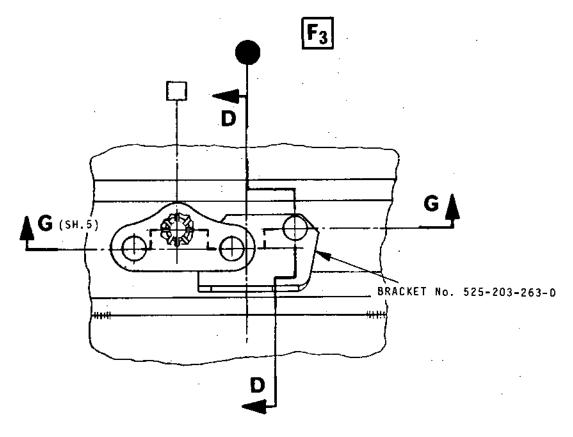




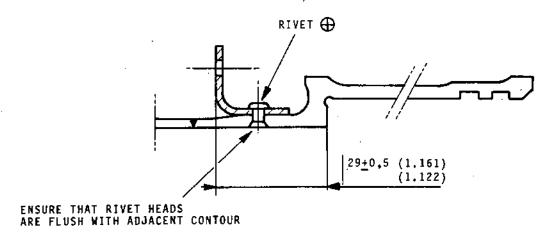
Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 2 of 8

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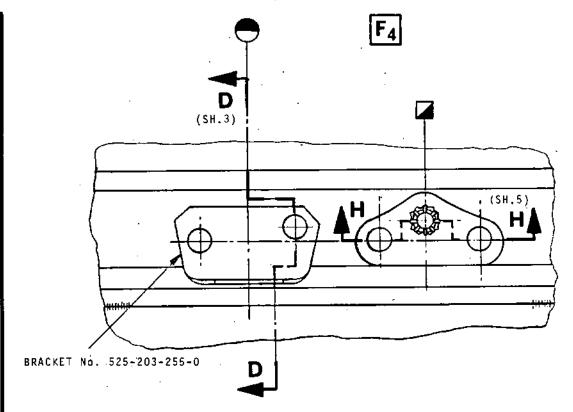
SECTION D-D (BRACKET ATTACHMENT)

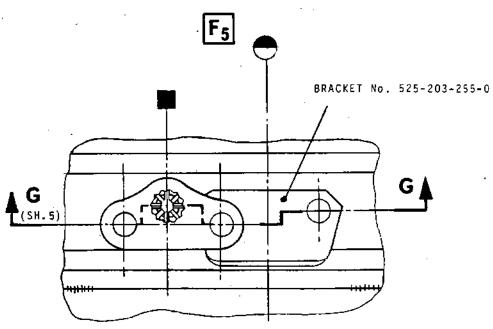


Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 3 of 8

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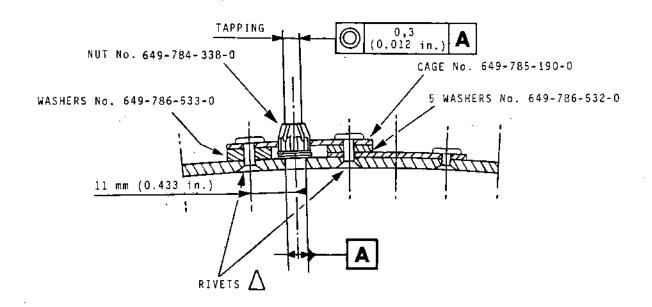
Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 4 of 8

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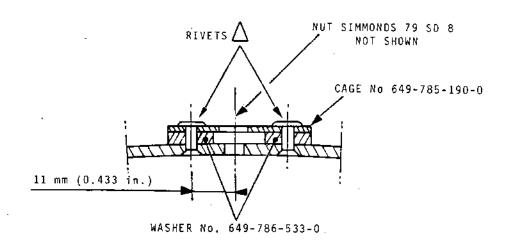
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SECTION GG (VALID AT 4 LOCATIONS ■ AND 1 LOCATION □)



SECTION HH (VALID AT 10 LOCATIONS)



Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 5 of 8

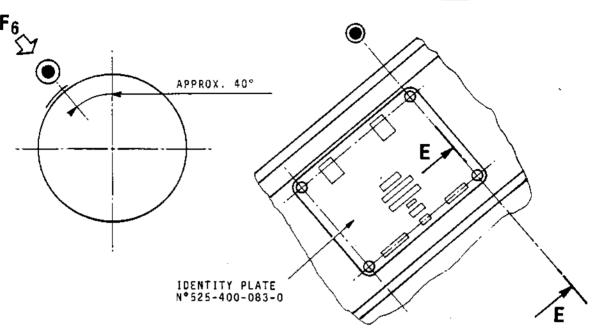
REPAIR

72-54-01 REP 6-180-2 Page 406 Jul 31/93

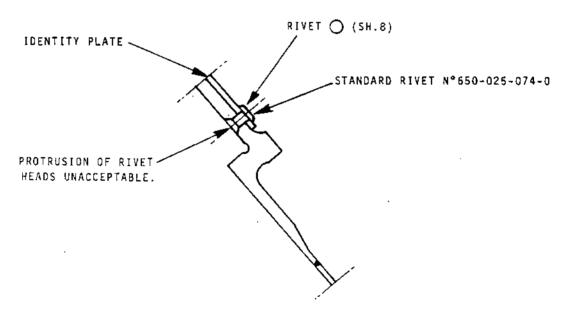


LAY-OUT OF SECTION CC





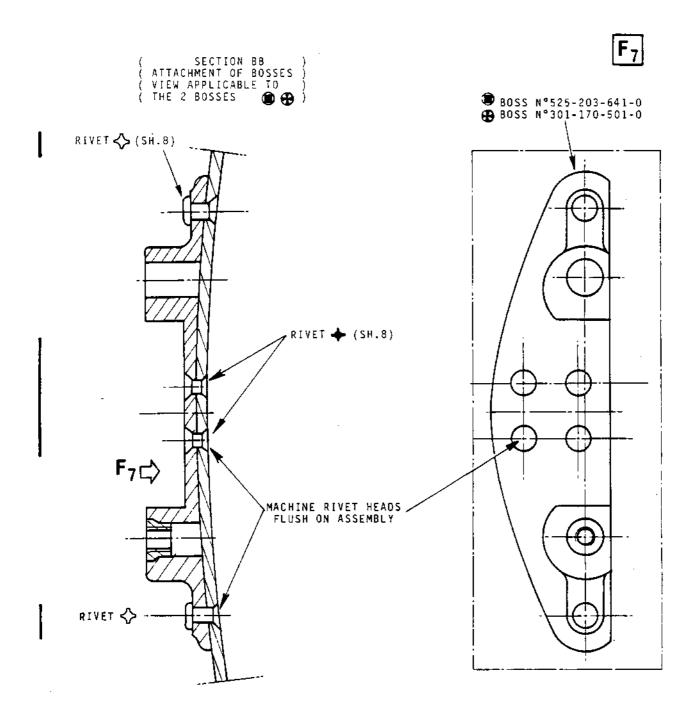
SECTION EE



Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 6 of 8

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Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 7 of 8

REPAIR

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TABLE I - RIVET DETAILS

| | Standard Rivet | Dia. | L | Mate- rial | Head | Countersunk hole | |
|-------|----------------|---------------------------------------|---------------|---------------|----------|---|-------|
| | Repair Rivet | mm (in.) | mm (in.) | | | diameter mm in. | |
| | 21217 TC 3208 | ж | ж | × | ж | 5,8 ⁺⁰ ,2 (0.228) (0.236) | |
| | 21217 TC 4009 | × | ж | ж | X | $7,4^{+0},2$ (0.291) (0.299) | 0 |
| | 21217 TC 3209 | 30 | ж | ж | 30 | × | ф. |
| ľ | 21217 TC 4010 | :: | × | × | 26 | ж | Ψ |
| | 21217 TC 4009 | >6 | × | ;; | :c | $7,4^{+0},2$ (0.291) (0.299) | |
|] | 21217 TC 4810 | * | ж | × | × | $9,1^{+0},2$ (0.358) + 0 (0.366) | |
| | 650-025-106-0 | 4 (0.157) | 13 (0.512) | NC 15 Fe | F 100 | $7,4^{+0}_{+0}$, (0.291) (0.299) | ♦ |
| ı | 21217 TC 4814 | ж | ж | ж | # | $9,1^{+0}_{+0}$, (0.358) (0.366) | \ |
| | 21217 TC 3212 | * * * * * * * * * * * * * * * * * * * | × | ж | * | н | Δ |
| 1 | 650-025-106-0 | (0.157) | 13 (0.512) | NC 15 Fe | F 100 | × | |

[&]quot; Refer to the "Standard Practices" manual, chapter 70-50-10, "RIVETING", for these data.

Renewal of Rivets or Defective Rivetted Parts Figure 401 - Sheet 8 of 8

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SPHERICAL JOINT FLANGE 6-180

3. Renewal of the bushes in revetted bosses

PARTS REQUIRED FOR REPAIR

Bush No. 525-203-089-0

Rivet No. BNAE 21217 TC 4009 (650-025-102-0)

or No. BNAE 21217 TC 4810 (650-025-133-0)

Rivet No. 650-025-106-0

or No. BNAE 21217 TC 4814 (650-025-137-0)

Filler welding wire P 3020

A. Removal of the boss

(1) Remove the boss in which the bush is to be renewed as per repair scheme REP 6-180-2.

B. Removal of the bush

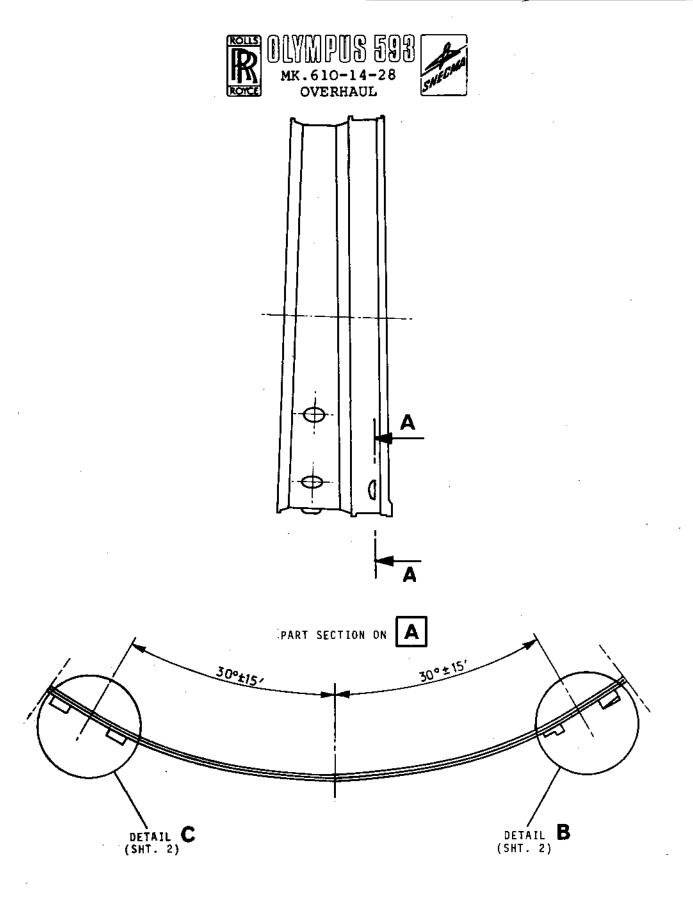
- (1) Grind the two weld points which retain the bush, taking necessary precautions not to damage the boss.
- (2) Push out the bush with a press.
- C. Re-assembly of the bush.
 - (1) Fit a new bush, previously shrunk in liquid nitrogen (P 441) as per figure 401.
 - (2) Retain the bush by two argon-arc weld points.
 - filler weld wire P 3020
 - weld class Bl
 - (3) Inspect the B1 class weld as per instructions in chapter 70-35-80
 - crack test using water-washable fluorescent dye pene trant using method M 502 B of chapter 70-20-10.
 - (4) Machine the welds flush with the contact face of the boss.

D. Re-assembly

Re-fit the boss as per repair scheme REP 6-180-2.

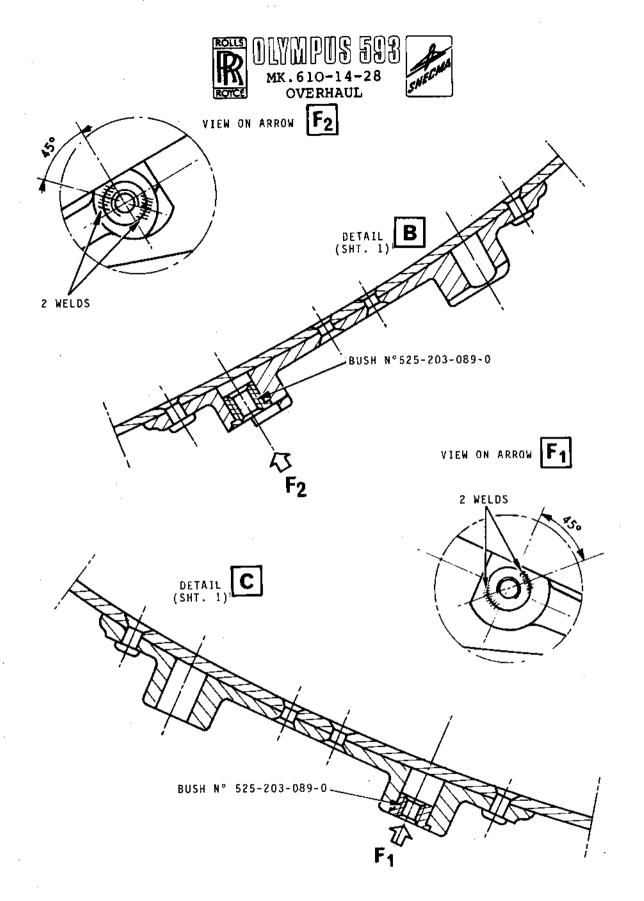
REPAIR

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Renewal of Bushes in Rivetted Bosses Figure 401 - Sheet 1 of 2

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Renewal of Bushes in Rivetted Bosses Figure 401 - Sheet 2 of 2

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SPHERICAL JOINT FLANGE (6-180)

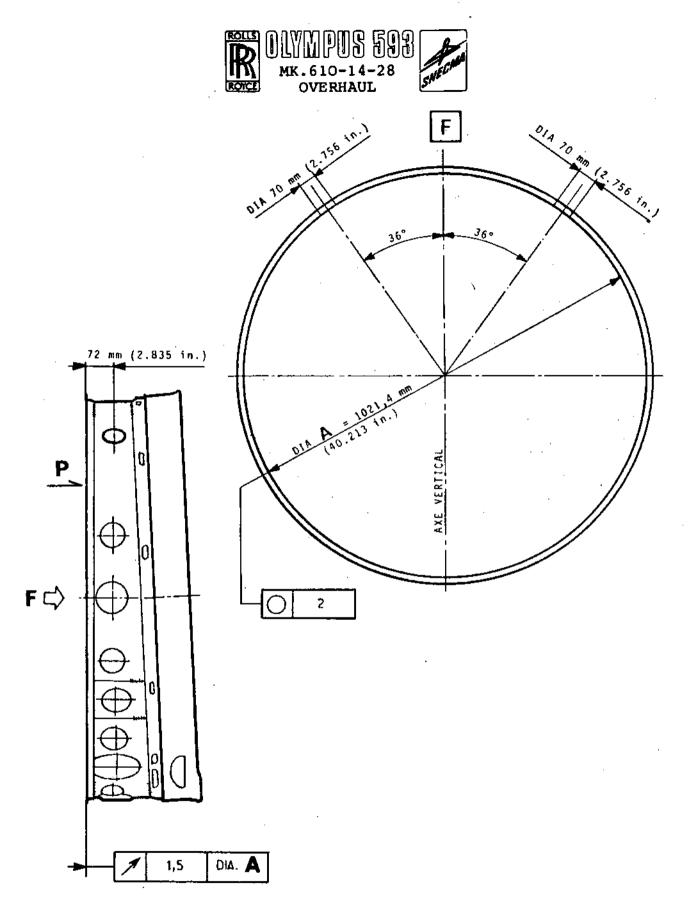
4. Removal of bosses provided for pressure tapping

PARTS REQUIRED FOR REPAIR

Sheet metal P 3320, thickness 1,5 mm (0.060 in.) Weld filler wire P 3020.

- A. Removal of existing bosses
 - (1) Cut out the two pressure tapping bosses in accordance with the indications of figure 401.
- B. Installation of welded patches.
 - (1) Patches are to be cut out from sheet metal material P 3320, 1,5 mm (0.060 in. thick.
 - (2) Fit, then weld the patches according to the instructions given in chapter 70-35-10 "WELDING" and as follows:
 - weld filler wire P 3020
 - weld class : B2
 - (3) Inspect welds, class B2, according to the instruction given in chapter 70-35-80 "WELDING" and as follows:
 - water washable fluorescent penetrant test as per process M 502 B of chapter 70-20-10.
 - X-rays check as per chapter 70-20-30
 - (4) Grind welds flush
 - (5) Inspect the welds for soundness using the water washable fluorescent penetrant process M 502 B of chapter 70-20-10 "DYE PENETRANT TEST".
 - (6) Dimensionally check the spherical joint flange at the front flange plane, as indicated on figure 401.

REPAIR



Removal of Bosses Figure 401

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REPAIR

SPHERICAL JOINT FLANGE (6-180)

5. Re-conditioning the Rear Flange Inner Contact Surface Through Metal Spraying (Metallizing)

PARTS REQUIRED FOR REPAIR

Cobalt alloy powder (fine) P 3205 Nickel/Aluminium powder P 3203

A. General

- (1) Depending on the extent of the defect, it may be necessary to apply an undercoat before spraying of the final coat.

 The total thickness of the coating must not exceed 1.3 mm (0.052 in.).
- (2) If the part has already been reconditioned through metal spraying, remove metallization as instructed under para. B.
- B. Removing the deteriorated metallization
 - (1) Remove the damaged metallization by abrasive blasting according to method M 103 A in chapter 70-15-20 "CLEANING AND REMOVAL OF COATINGS".
 - NOTE: Omit the degreasing operation. Protect the surfaces surrounding the area to be abrasive blasted using metal shields.
- C. Dimensionally inspect the area to be metal sprayed
 - NOTE: This operation is required only if the inner contact surface was previously metallized.
 - (1) Measure and record the average diameter of the rear flange inner contact surface in planes Pl and P2. This check allows to determine the thickness of metal spraying required in the various planes of the inner contact surface.



(2) Checking method (Ref. Fig. 401)

CAUTION: A 10°C TEMPERATURE VARIATION RESULTS IN A 0,13 MM (0.00512 IN.) LINEAR CHANGE ON THE FLANGE DIAMETER.

The average inner diameter of the rear flange in plane Pl, then in plane P2, is found by working out the arithmetical mean of the 18 values recorded in the plane concerned.

To carry out these measurements, proceed in the following manner:

(a) On the inner diameter, mark 18 generatrices equally distributed on the rear flange halfcircumference.

CAUTION: IN ANY CASE, MARKING MUST NOT DETERIORATE THE SURFACE CONDITION OF THE FLANGE INNER DIAMETER.

- (b) Using the resizing tool SC 118, round the flange inner diameter.
- (c) Calibrate the TESA UNIMASTER gage (TESA S.A. -1020 - RENENS - VD/SWITZERLAND. Agent in France : SYNERGIE, 27 avenue Philippe Auguste - 75011 PARIS - Tel. 357.21.00).

Fit the gage with :

- the extension tubes required for obtaining the dimension to be checked,
- 2 the supports correctly adjusted to ascertain the measuring plane (P1 then P2).
- (d) Bear the gage supports on to the flange edge and measure.
- (e) Repeat this operation at the level of the 18 marks.



- D. Metallizing the rear flange inner contact surface
 - (1) Prepare the area to be metal sprayed as instructed in chapter 70-65-20 "SPRAYING OF COATINGS USING A PLASMA TORCH".

NOTE: Perform dry abrasive blasting using corundum 160 (P 137) at a pressure of 3,5 bars (51 psi).

- (2) Carry out the metal spraying as instructed in chapter 70-65-20 "SPRAYING OF COATINGS USING A PLASMA TORCH" in compliance with the requirements shown on figure 402 and the following additional instructions:
 - (a) Spraying of an undercoat, if applicable:
 Nickel/aluminium powder P 3203
 Maximum coat thickness 1 mm (0.039 in.)
 - (b) Spraying of final coating: Cobalt alloy powder material P 3205 Maximum coat thickness 0,3 mm (0.012 in.)
- (3) If required, smooth the surface discontinuities by sanding with an emery cloth.

E. Inspection

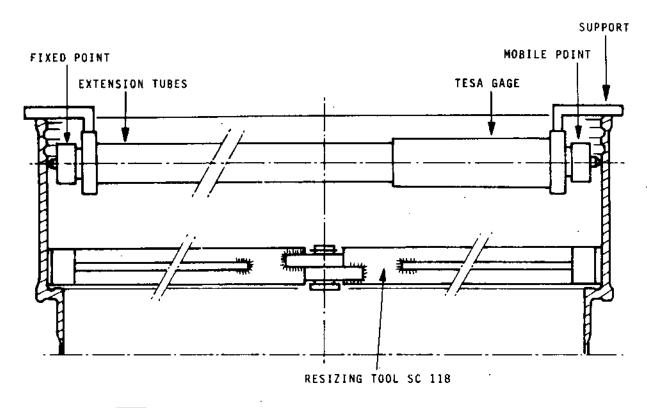
- (1) Inspect the metallization as specified in chapter 70-65-80 "INSPECTION OF COATINGS".
- (2) Dimensionnally inspect the rear flange inner contact surface as indicated in figure 402.

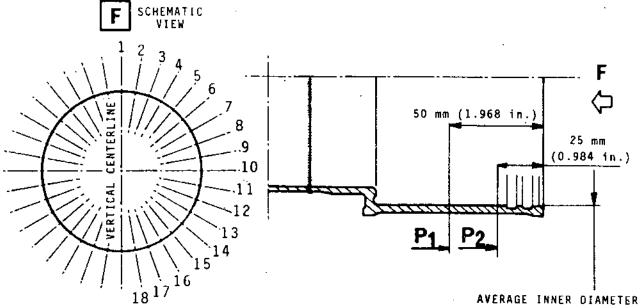
 The inspection method is similar to that defined under para. C. (2).

F. Marking

(1) Following the part number, mark "REP 5" as per method M 28 of chapter 70-10-10 "METHODS OF MARKING".



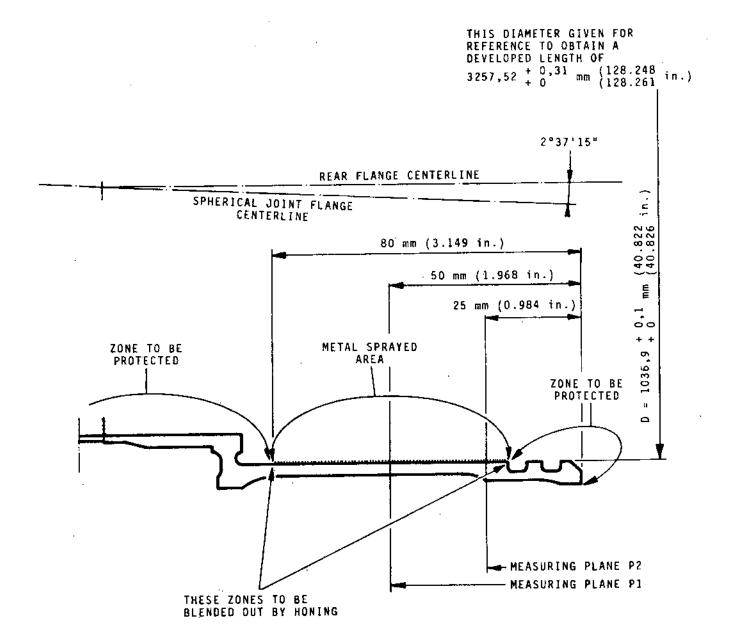




Checking the Average Inner Diameter of the Rear Flange Figure 401

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Metal Spraying the Inner Flange Inner Contact Surface Figure 402



REPAIR

SPHERICAL JOINT FLANGE (6-180/60)

6. Reconditioning Tapped Holes in Bosses through Bush Installation

PARTS REQUIRED FOR REPAIR

Stock bar P 3623 (KC 20 WNx)
Weld filler wire P 3020 (KC 20 WNx)

A. Machining

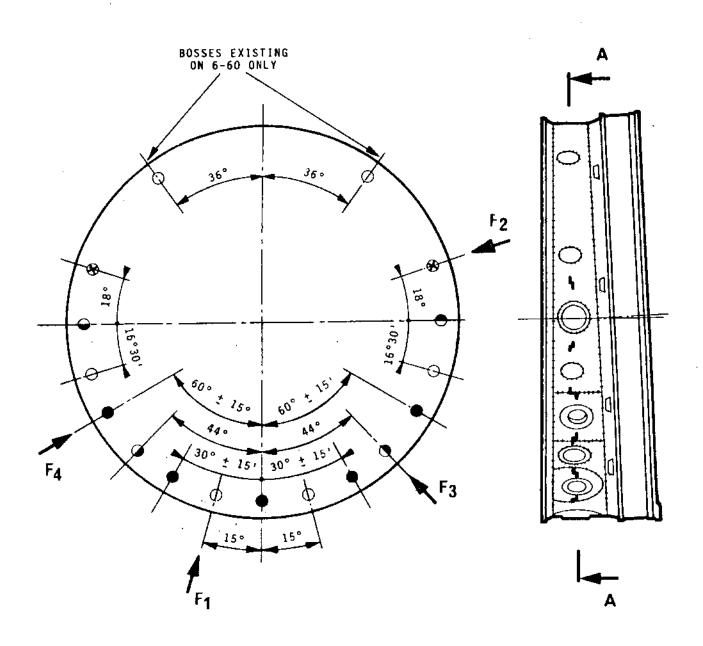
- (1) Drill, spot-face and tap the defective tappings as instructed in figure 401.
- (2) Depending on the tappings to be repaired, machine the bushes as instructed in figure 402 or 403.
- B. Installing the bushes
 - (1) Locate the bushes after having their external screw thread lightly coated with lanolin (P 194).
 - (2) Using a drill, produce two diametrically opposed indentations as specified in figure 401, sheets 3 of 4 and 4 of 4.
 - (3) Argon-arc plug weld the above indentations as instructed in chapter 70-35-10.
 - (a) Filler welding wire P 3020
 - (b) Weld class B1
 - (4) Inspect the welds, class B1, as instructed in chapter 70-35-80.
 - (a) Water washable fluorescent penetrant inspect as per method M 502 B in chapter 70-20-10.
 - (5) Grind the weld points and the bush faces flush with the boss surface (inner and outer).



- (6) If required, bring the bush tapping to size and resize blind holes in the identified bosses, if applicable. (Ref. figure 401, sheets 2/4 and 3/4).
- C. Inspection
 - (1) Dimensionnally inspect the reconditioned bosses.
- D. Marking
 - (1) Following the part number, mark "REP 6" as instructed in method M 28 of chapter 70-10-10.



SECTION AA - SCHEMATIC

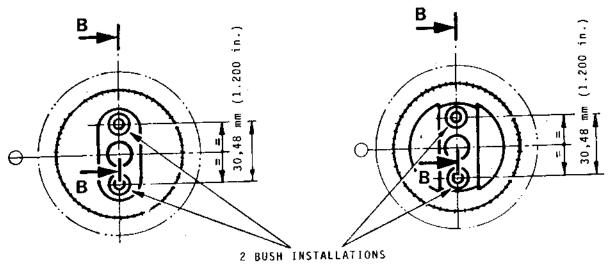


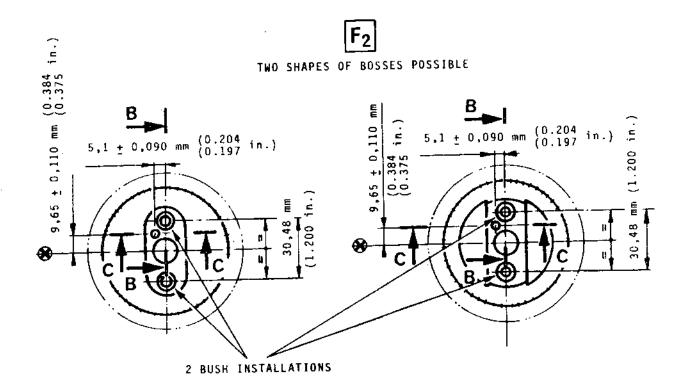
Installing Bushes in Tapped Holes of Bosses Figure 401 (Sheet 1 of 4)

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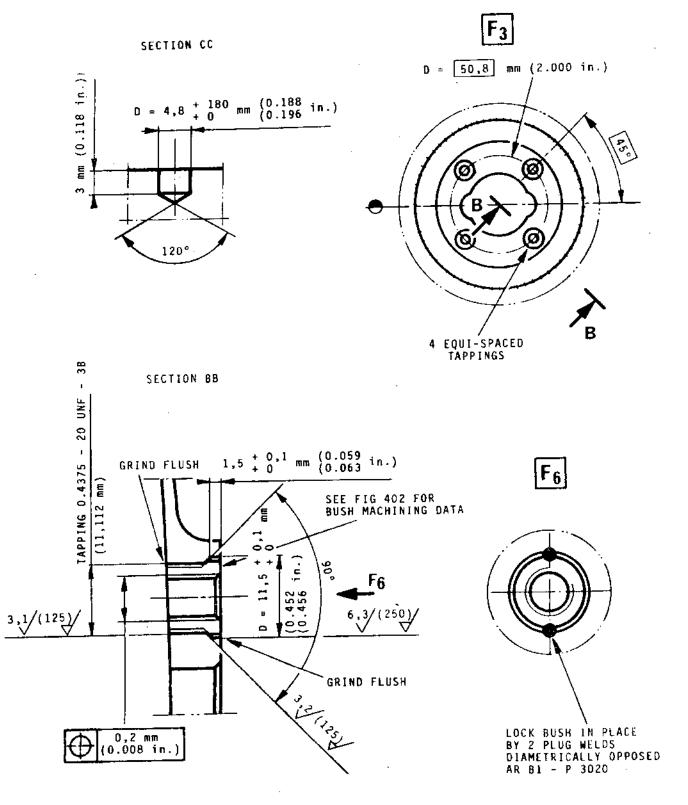




Installing Bushes in Tapped Holes of Bosses Figure 401 (Sheet 2 of 4)

> 72-54-01 REP 6-180-6 Page 404 Sep 1/78



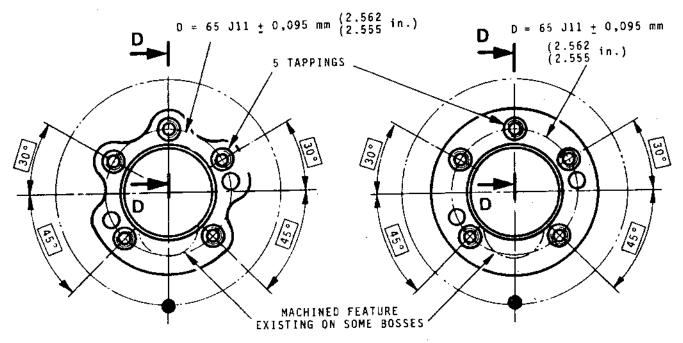


Installing Bushes in Tapped Holes of Bosses Figure 401 (Sheet 3 of 4)

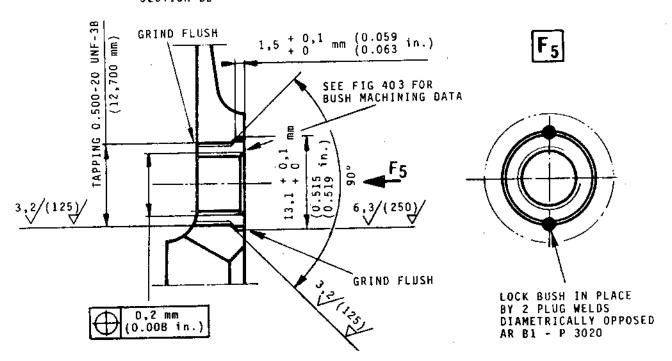
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F4 TWO SHAPES OF BOSSES POSSIBLE

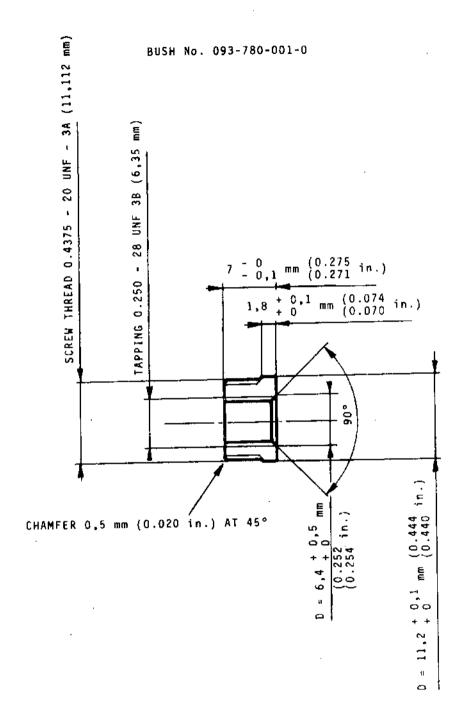


SECTION DD



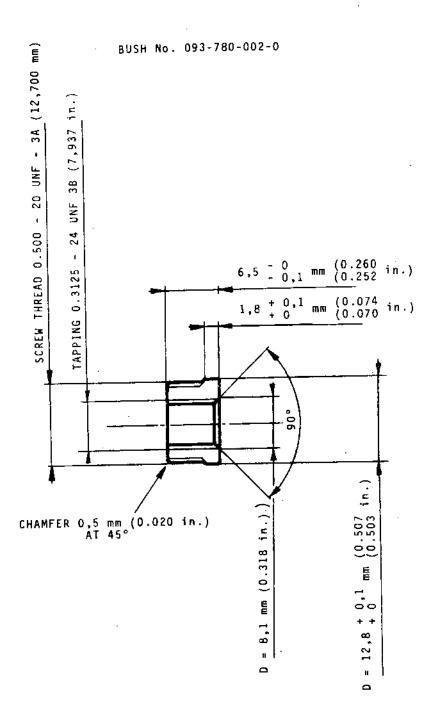
Installing Bushes in Tapped Holes of Bosses Figure 401 (Sheet 4 of 4)

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Bush for Reconditioning Tappings 250 - 28 UNF 3B Figure 402





Bush for Reconditioning Tappings 3125 - 24 UNF 3B Figure 403



REPAIR

SPHERICAL JOINT FLANGE (6-180)

7. Re-shaping the Rear Flange

PARTS REQUIRED FOR REPAIR

- A. Take down all the riveted items lying in the deformed zone and all around it as instructed in REP 6-180-2. These items will be re-installed after re-shaping in accordance with the same instructions.
- B. Ascertain there is no crack in the warped zone by conducting a local, water-washable fluorescent penetrant test as instructed in method M 503 B in chapter 70-20-10.
- C. By sanding using a fine emery cloth, smooth out all the sharp edges lying in the warped zone, especially on each rivet hole.
- D. Carry out the re-shaping of the rear flange by peening after having the area to be "straightened" previously heated at some 600°C.
- E. Soundness inspect the re-shaped area by conducting a local, water-washable fluorescent penetrant test, as instructed in method M 503 B of chapter 70-20-10, followed by a X-ray inspection in accordance with chapter 70-20-30.
- F. Dimensionally inspect the spherical joint flange as shown on figure 401.
 - (1) Inspection method

CAUTION: A 10°C TEMPERATURE VARIATION RESULTS IN A 0,13 MM (0.005 IN.) LINEAR CHANGE ON THE FLANGE DIAMETER.

The average inner diameter of the rear flange in plane P1 then, in plane P2, is found by working out the arithmetical mean of the 18 values recorded in the plane concerned.

Perform these measurements as follows :

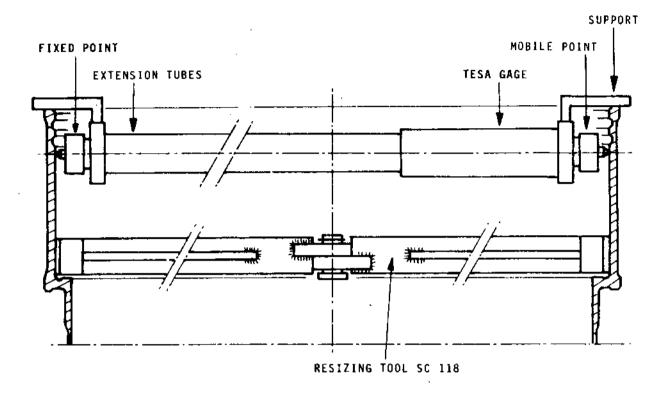
(a) On the inner diameter, mark 18 generatrices equally distributed on the rear flange half-circumference.

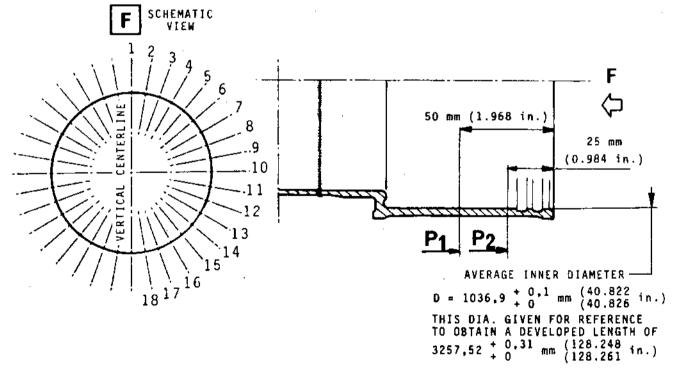
CAUTION: IN ANY CASE, THESE MARKS MUST NOT IM-PAIR THE SURFACE CONDITION OF THE FLAN-GE INNER DIAMETER.

- (b) Using the resizing tool SC 118, restore the roundness of the flange inner diameter.
- (c) Calibrate the TESA UNIMASTER gage (TESA S.A. 1020 - RENENS - VD/SWITZERLAND). Agent in France: SYNERGIE, 27 avenue Philippe Auguste - 75011 PARIS - Tel. 357.21.00).

Fit the gage with :

- the extension tubes required for obtaining the dimension to be checked.
- the supports correctly adjusted to ascertain the measuring plane (P1 then P2).
- (d) Rest the gage supports on the flange edge and perform measurement.
- (e) Repeat this operation in line with the 18 marks.
- G. Following the part number, mark "REP 7" as per method M 28 of chapter 70-10-10.





Dimensional Inspection of the Rear Flange Figure 401

/2-54-01 REP 6-180-7 Pages 403/404 Sep 1/78



INTERNAL ACCESSORY DRIVES - REPAIR

TABLE OF CONTENTS

| | Repair No. | Title | Scheme No. |
|------------|------------|---|--------------|
| | . 1 | HP Probe Operating Labyrinth Fins Repaired by Roll Forming | SAL.B.478092 |
| ENGLAND | . 2 | Gearshaft Bevel Zerol Pinion - Removal of Fretting on Outer Face by Machining | SAL.B.513508 |
| PRINTED IN | 3 | Housing, Assembly of, Bearing 1.850 (46,99) 1.8507 (47,008) Diameter Bore Restored by Chromium Plating | SAL.B.513544 |
| | 4 | Housing, Assembly of, HP Drive. Restoration of seal location by chromium plating | SAL.B.514698 |



MK.610-14-28 snecma OVERHAUL

INTERNAL ACCESSORY DRIVES - REPAIR HP PROBE OPERATING LABYRINTH FINS REPAIRED BY ROLL FORMING

MODIFICATION NO. OL.7507C, OL.8807C

<u>Effectivity</u>

| <u> </u> | Fig./Item | Part No. |
|----------|-----------|----------|
| 72-61-00 | 1 30A | B.475054 |
| | 1 30B | B.494287 |

1. Introduction

- A. This Repair describes the procedure for restoring defective fins on the labyrinth ring, in order to maintain the standard fin/housing clearances of labyrinth No.10B. The diameter of each fin is first increased by roll forming then machined to standard dimensions.
- B. Refer to Chapter 72-09-00, Repair for all standard practices, tolerancing and the roll forming technique applicable to this repair procedure.
- C. Dimensions are shown thus on illustrations: INCHES (MILLIMETRES).

2. Repair Limitations

- A. Fins which have previously been repaired by welding must not be restored by roll forming.
- B. The first repair to each labyrinth ring must be carried out in accordance with paragraph 3. Subsequent repairs must be carried out in accordance with paragraphs 3 and 4.
- C. Verify that there is adequate material at the defective location to permit machining to the dimensions before roll forming (Ref.para.3 and 4).

3. Summary of Operations

- A. Secure the labyrinth ring to the centre-lathe face-plate and set true on datum diameter A and face B (Ref.Fig.401).
- B. Clean up defective fins; remove only the minimum amount of material to achieve the dimensions before roll forming (Ref. Fig. 402). A localised "witness", not exceeding 0.003 in. (0,076 mm) in depth is acceptable on each fin.

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- C. Carefully remove any burrs.
- D. Apply the roll forming technique to increase the diameter of defective fins to the specified dimensions (Ref.Fig.403).
- E. Remove any folds by careful blending (Ref.Fig.404).
- F. Crack test the ring by the process specified for this component in 72-61-00, Inspection/Check.
- G. Finish machine the fins (Ref.Fig.401); a maximum of 1.000 in. (25,4 mm) of the circumference which has not cleaned up is acceptable on each fin.
- H. Polish the fins to remove sharp edges.
- J. Repeat the test for cracks (para.F.).
- K. Identify repair. Mark the repair scheme number SAL B.478092 close to the standard part number on the labyrinth ring. For the second repair, mark /2 against the existing repair scheme number.

4. Amended Dimensions for Repeated Rolling of No.10B Labyrinth Fins

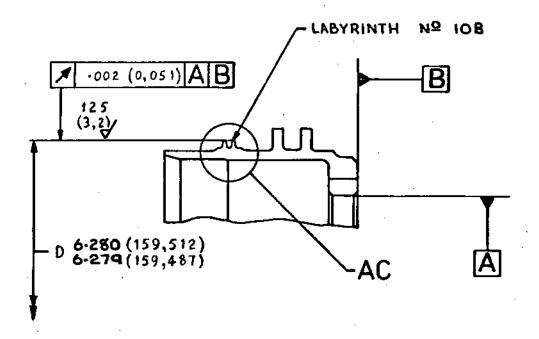
- A. Machining dimension before roll forming (Ref.Fig.402) may be reduced to 3.1285 in. (79,464 mm) minimum, if necessary.
- B. Roll forming radius (Ref.Fig.403) may be reduced to 3.139 in. (79,73 mm) minimum, if necessary.
- C. Standard dimension (Ref.Fig.401) may be reduced to 6.272 in. (159,31 mm) minimum, if necessary.

Special Tools, Fixtures and Equipment

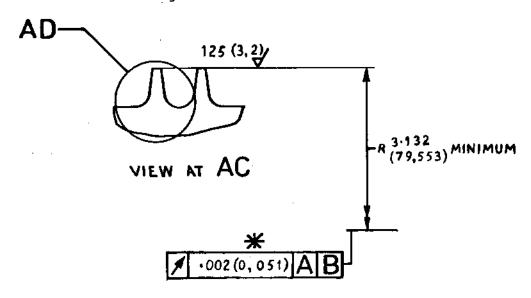
| Quantity | Tool No. | <u>Item</u> |
|----------|-------------------------------------|---|
| 1 | \$3\$12358000 | 1 |
| 1 | S3S12363000 | 2 |
| 2 | S3S12382000 | 3 |
| 4 | \$3\$12375-78000 | 4 |
| | <u>Quantity</u> 1 1 2 4 | 1 \$3\$12358000 1 \$3\$12363000 2 \$3\$12382000 |

6. Replacement Parts

A. Not required.



Standard Dimensions Figure 401

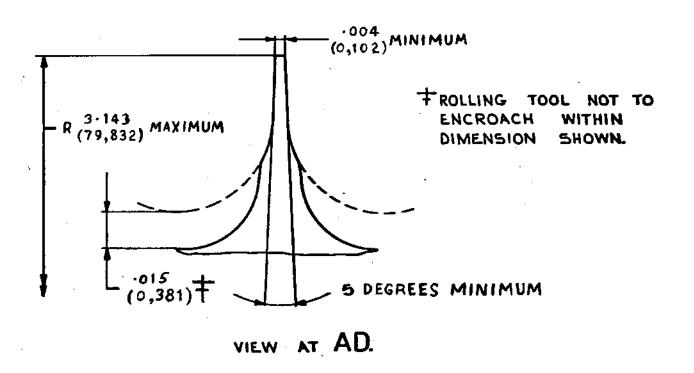


Machining Dimensions Before Roll Forming Figure 402

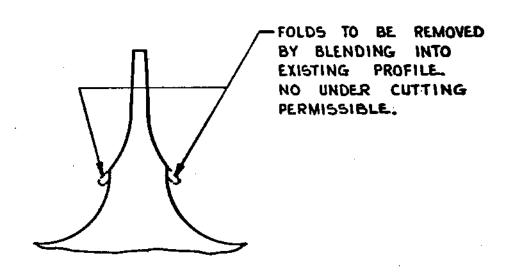
REPAIR

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Roll Forming Dimensions Figure 403



Fold Blending Detail Figure 404

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OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION NO. 72-506
Insert to follow 72-61-00 Repair 1 Page 404

REASON FOR ISSUE:

To introduce a repair scheme to restore the sealing face on bearing housing P/No.B492627 (MRA 53).

ACTION

Add new BEOL Repair to read as follows:

BEOL REPAIR: RST 4002 Bearing Housing: R.H. Gearbox: Restore sealing face by plasma spray.

PROCEDURE:-

- 1. Set running true. Machine to pre-spray dimensions. Refer to Fig. a. .
- 2. Crack test per normal overhaul procedure F2A.
- Prepare machined surface for Plasma Spray per T.S.D.594 704.
- 4. Plasma Spray build up using Tungsten Carbide to MSRR.9507/1 (See Fig.b) Spray per T.S.D. 594 704 use Stellundum 52F Powder. Refer to Sheet 2 and 3 for parameters.
- 5. Machine to finished dimensions by grinding. Refer Fig. c.
- 6. Inspect for cracks and lack of adhesion of the sprayed coating Refer T.S.D. 594 - 704.
- 7. Resin seal PLASMA SPRAYED AREA as follows:-
 - (a) Trichlorethylene Vapour Degrease.
 - (b) Very lightly blast using 120/220 Grit in areas to be coated.
 - (c) Pre-heat to 120° 150°C.
 - (d) Using Polymide clear coating PL_163, Viscosity 35 to 45 seconds with flow cup type B4 (at 20°C) and thinners Spec. 3000-5-1214 (all Pinchin Johnson Supply). Spray one coat only .006 MM to .013 MM thick over Plasma Coated area.
 - (e) Stove for two hours at 190°C + 5°C (after unmasking).
- Vibro-engrave 'RST. 4002' adjacent to Part No.

PLASMA SPRAY DATA & PARAMETERS

MATERIAL

Designation & Title - Stellundum 52F

Supply - Deloro Stellite Ltd.

Mesh Range - 20-50 Micons

British airways

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EQUIPMENT

Gun Metco 3 MB Cathode 3M-IIA Anode 3M-7A-GP
Secondary Gas Flow Tube 2M-375 Powder Port 3M-325-NO2
Gases:ARC Primary Argon Pressure 100 psi
ARC Secondary Hydrogen Pressure 50 psi
Power Supply:Current 500 AMPS Voltage 460 Volts

OPERATING CONDITIONS

Gas Flow:Primary 100 SCFH
Secondary 80 SCFH
Power Settings:Current (Approx) 400/420 AMPS
Voltage (Approx) 55 Volts
To give Power Level of 22-23 KW
Powder Control:Meter Wheel S
Meter Wheel Speed 14 r.p.m. +
Carrier Gas Flow 35 SCFH
Powder Delivery Rate 57 GS/MIN 7.5 LRS/HR.
Deposit Efficiency 75%

SPRAYING PARAMETERS

Q

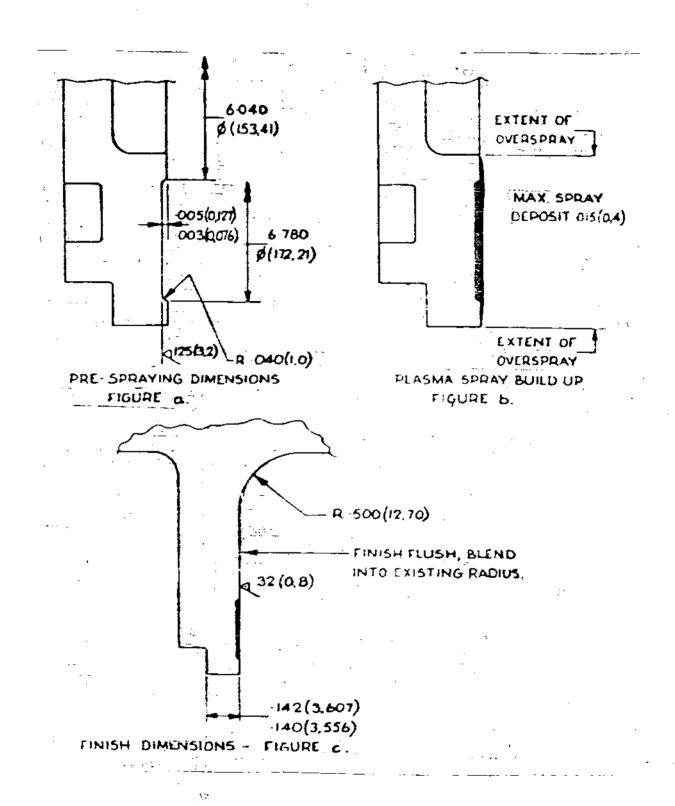
Gun to Work Distance 3-4 ins
Maximum Thickness of Coating 0.100 (Finished) ins.
M.S.R.R. 9507/1
+ To be completed at each facility

This R.S.T. is written in accordance with OLY/SEDP/467 and DOI.T.7016.

TR.72-506 72-61-00 TR Page 2 of 3 RST 4002

British airways

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GEARSHAFT BEVEL ZEROL (PINION) - REPAIR PROVISION TO REMOVE FRETTING ON OUTER FACE BY MACHINING

REPAIR NO.B513508

1. Effectivity

| I.P.C. | Fig | ./Item | Part No. |
|----------|-----|--------|----------|
| 72-61-00 | 1 | 42E | B499145 |

2. Introduction

A. General.

- (1) This repair describes the procedure for removing, by machining, fretting on the outer face of the gearshaft bevel drive pinion.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0,50 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in (0,25 mm) unless otherwise stated.
- (6) Tolerances on machined angles are plus/minus 2 degrees unless otherwise stated.

B. Repair Limitations.

- (1) Compliance with all aspects of these repairs should be achieved without deviation. Where a need to deviate is considered necessary, agreement should first be sought from the Repair Authority.
- (2) Refer to Figure 401. Maximum dimension AB must not exceed 0.130 in. (3,30 mm) after repair.

CAUTION:

AFTER REPAIR OF GEARSHAFT BEVEL, ENSURE A
MINIMUM NIP OF 0.009 IN. (0,23 MM) IS
MAINTAINED BETWEEN DAMPER PLATE PART NO.
B497157 AND GEARSHAFT BEVEL WHEN ASSEMBLED
(REFER TO FIGURE 402).

REPAIR

72-61-00

3. Instructions

- A. Preparation.
 - (1) Refer to Figure 401. Mount component in a universal grinder and set true to datums A and B.
- B. Machine.
 - (1) Refer to Figure 401. Grind the outer face of the bevel gear to remove fretting.
- C. Inspect.
 - (1) Check dimensions of machined area.
 - (2) Carry out a magnetic particle crack detection check on the machined area as specified in Chapter 72-61-00, Inspection/Check.
- C. Identify.
 - (1) Mark the component SAL B513508 adjacent to the existing part number using vibro-percussion engraving marking as specified in Chapter 72-09-00, Repair.
- 4. Special Tools, Fixtures and Equipment

None.

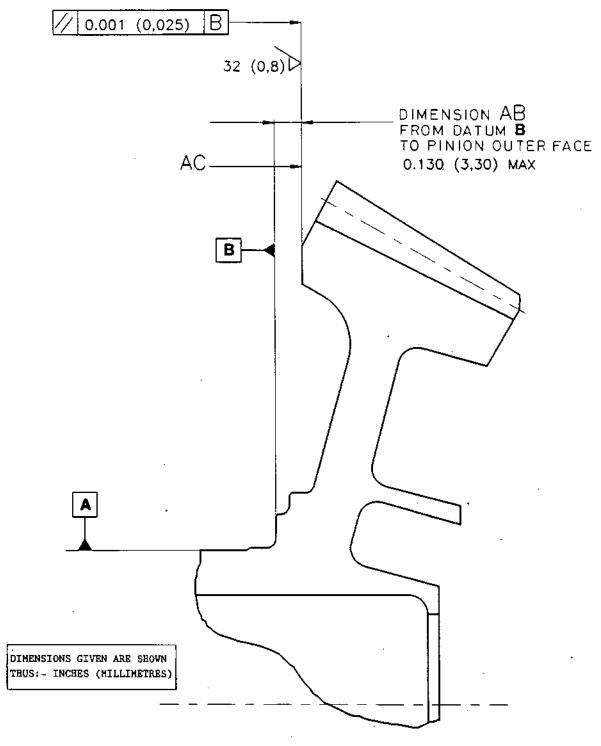
Replacement Parts

None.

REPAIR

72-61-00





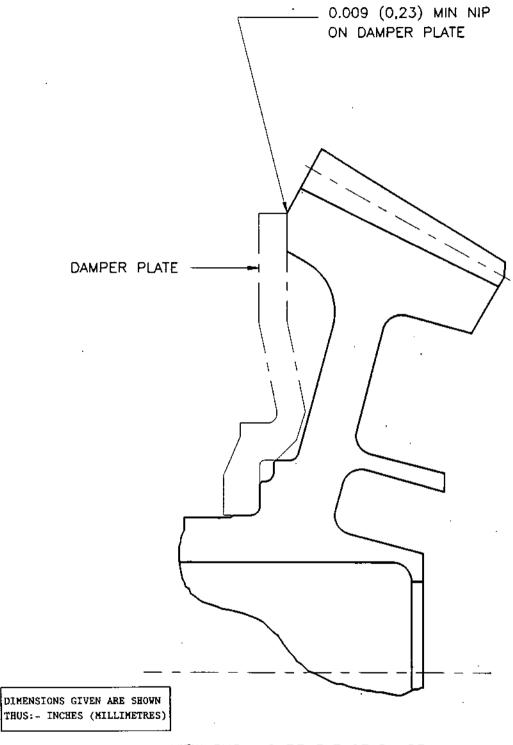
VIEW SHOWING MACHINING OF BEVEL GEAR.

Gearshaft Bevel Drive Pinion Figure 401

REPAIR

72-61-00

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VIEW SHOWING FITMENT OF DAMPER PLATE.

Gearshaft Bevel Drive Pinion Figure 402

REPAIR

72-61-00

Repair No.2 Page 404 Jun 1/91



HOUSING, ASSEMBLY OF, BEARING 1.850 (46,99)/1.8507 (47,008) DIAMETER BORE RESTORED BY CHROMIUM PLATING.

REPAIR NO. 8513544

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-61-00

02 180A

B475103

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

Maximum repairable diameter of Housing Bearing bore is 1.862 (47,29). Refer fig. 401.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Locate component on an internal grinder and set true to datum A.

Refer fig.401

Machine bore to pre-plating dimensions. Refer fig.401

3) Dimensionally inspect.

Refer fig. 401

72-61-00 Repair No.3 Page 401 Dec 1/91



4) Crack detect repair area.

Refer Overhaul Manual Chapter 72-61-00 Inspection/Check

5) Heat treat for 1 hour at 200° C \pm 10°C then air cool.

6) Chromium plate area AB with sufficient thickness to ensure finished bore dimensions can be maintained. Refer Overhaul Manual, Chapter 72-09-07 Repair. Refer fig.402

7) Visually inspect coating for defects. Ensure edges of plating are smooth and continuous. Refer Overhaul Manual Chapter 72-09-07 Repair.

8) Heat treat at 200°C ± 10°C for 3 hours then air cool.

NB. Heat treatment must be carried out within 16 hours of plating.

 Locate component on an internal grinder and set true to datum A. Refer fig.403

10) Finish machine.

Refer fig. 403

11) Visually inspect coating for defects. Ensure edges of coating are smooth and continuous.

Refer Overhaul Manual Chapter 72-09-07 Repair.

12) Dimensionally inspect.

Refer fig.403

13) Crack detect plated area.

Refer Overhaul Manual Chapter 72-61-00 Inspection/Check

14) Mark SAL.B513544 or R3 and coating symbol CR adjacent to existing part number, using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair.

MATERIAL

COMPONENT

MATERIAL

RR CODE

HOUSING, ASSEMBLY OF, BEARING

CORROSION RESISTANT STEEL MSRR6503 EAK

72-61-00 Repair No.3 Page 402 Dec 1/91



6. DATA

NONE.

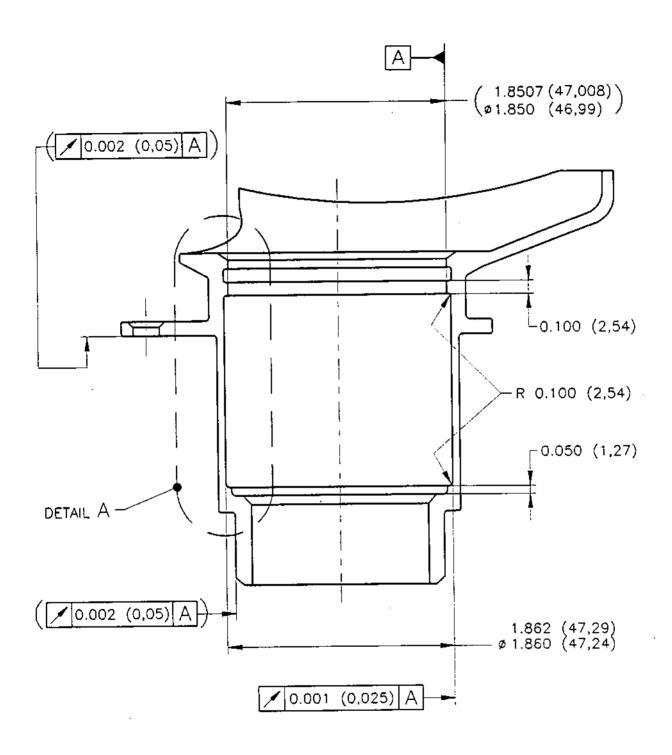
7. <u>TOOLS</u>

NONE.

8. REPLACEMENT PARTS

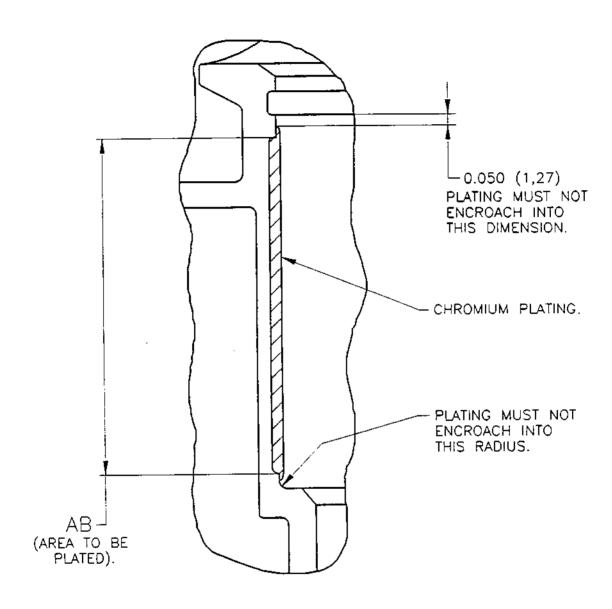
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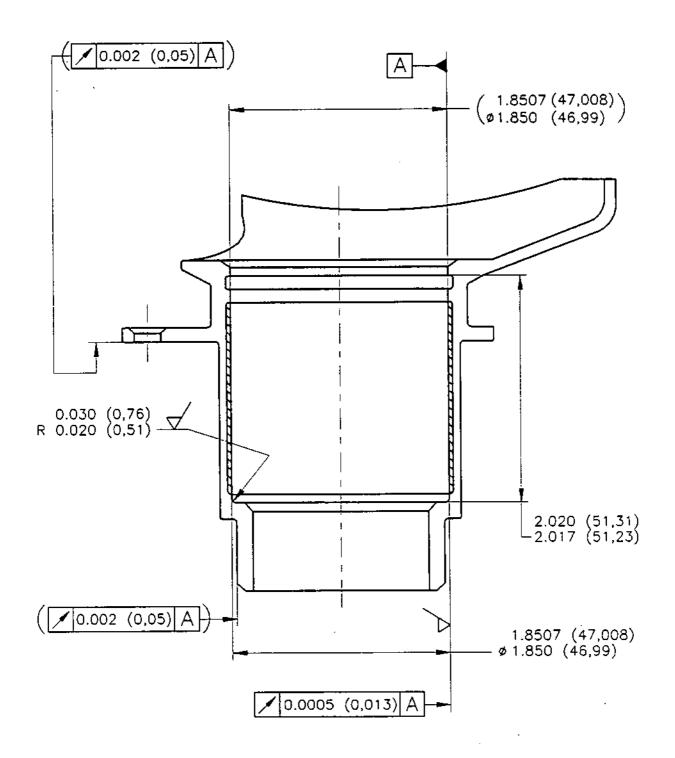
SECTION SHOWING PRE-PLATING DIMENSIONS FIG. 401

72-61-00 Repair No.3 Page 404 Dec 1/91



DETAIL A SHOWING PLATING REQUIREMENTS FIG. 402





SECTION SHOWING FINAL MACHINING DIMENSIONS FIG. 403

72-61-00 Repair No.3 Page 406 Dec 1/91



HOUSING, ASSEMBLY OF, HP DRIVE

RESTORATION OF SEAL LOCATION BY CHROMIUM PLATING

REPAIR NO. B514698

1. EFFECTIVITY

| IPC | Fig./Item | Part No. |
|----------|----------------------------|--|
| 72-61-00 | 1 330A 1 330B 1 570A | B484095, B484096 B499253, B499254 B484093, B484094 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair may be embodied any number of times provided that stated dimensions are not exceeded (refer fig.402).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 63 (1,6) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

REPEAT REPAIRS ONLY (for new arising proceed to op.3).

Mask off all areas except area AC and strip existing chromium plating. Use solution specified for Stainless steels. Refer TSD 594 OP.308. Refer fig.402.

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Repair No. 4
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 Locally etch area AC to ensure plating has been completely removed. Refer Overhaul Manual Chapter 72-09-14 Repair Solution E.

NEW ARISINGS ONLY (For repeat repairs proceed to op.5).

3) Set housing true to datums A and B.

Refer fig.401.

4) Machine defective seal location diameter to remove fretting. Remove the minimum amount of material from diameter X. Ensure minimum plating and wall thickness limitations are maintained.

Refer fig.401 and 402.

5) Dimensionally inspect repair area.

Refer fig. 402.

6) Locally crack detect repair area. Refer Overhaul Manual Chapter 72-61-00 Inspection/Check

7) Chromium plate area AC.

Refer TSD 594 0P.308.

- a) Stress relieve prior to plating.
- b) Etch using solutions specified for Stainless steels.
- c) De-embrittle after plating for 3 hours (minimum) at 190 to 210°C.
- 8) Set housing true to datums A and B.

Refer fig.401.

9) Machine plated repair area AC to finished dimensions. Refer TSD 594 OP.308. Refer fig.401 and 402.

10) Dimensionally inspect.

Refer fig. 401 and 402.

11) Inspect plated area AC.
Penetrant inspection of the plated area is required.

Refer TSD 594 OP.308. Refer TSD 594 OP.210. Refer fig.402.

> 72-61-00 Repair No. 4 Page 402 Jun 1/92

12) Crack detect.

Refer Overhaul Manual Chapter 72-61-00 Inspection/Check

13) Mark Repair Instruction number RI B514698 or R4 and coating identity symbol adjacent to the normal 'assy of' no. using the electro-chemical marking or vibro-percussion engraving techniques.

Refer Overhaul Manual Chapter 72-09-00 Repair

Coating identity symbol CR

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

HOUSING, ASSEMBLY OF

JETHETE M190 MSRR6503 EAK

6. DATA

NOT APPLICABLE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

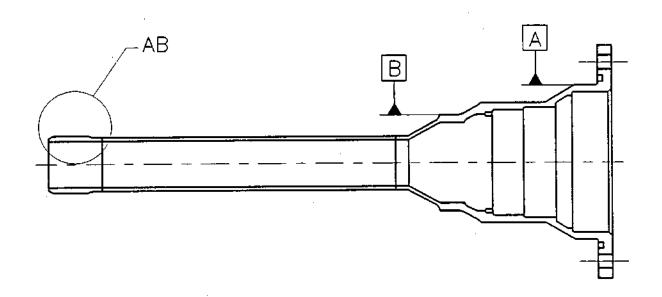
DESCRIPTION

QUANTITY

ITEM

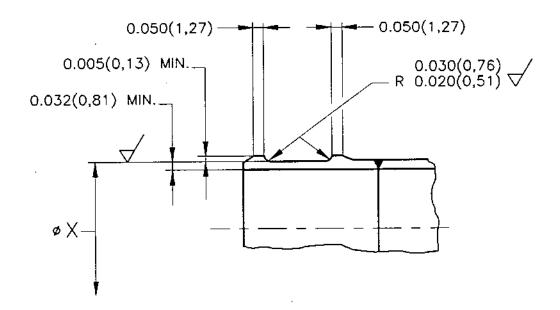
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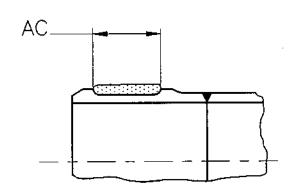


TYPICAL SECTION THRU HOUSING, ASSEMBLY OF, HP DRIVE. FIG.401

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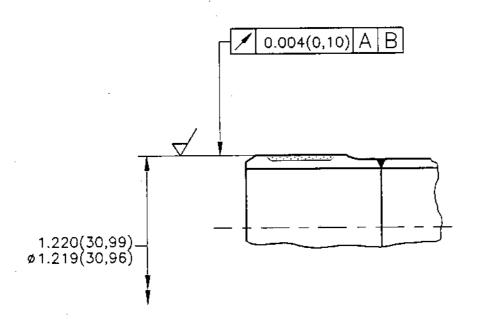
VIEW AT AB



REPEAT VIEW AT AB FIG. 402

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REPEAT VIEW AT AB FIG.403

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CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-529

Insert in 72-61-00 at rear of repair section in RST No. order

REASON FOR ISSUE:

H.P. Drive Housing Assy - restoration of fretting on O/D of ferrule at outer end of tube. (MRA 95).

ACTION

BEOL REPAIR: RST 4013. H.P. Drive Housing Assy - Restoring worn O/D of tube - chrome plating or replacement of tube end.

PROCEDURE

PART 1. REPAIR BY CHROME PLATING.

- 1. Machine end of tube to dimensions shown in Fig.1. (Note minimum wall thickness).
- Hard chrome plate O/Dia. of tube as per TSD 594-308 for stainless steel see Fig.2.
- 3. Grind plated area to 1.220"-1.219" finished dia. See Fig.3.
- 4. Crack detect as per Overhaul Manual.
- 5. Final inspect.

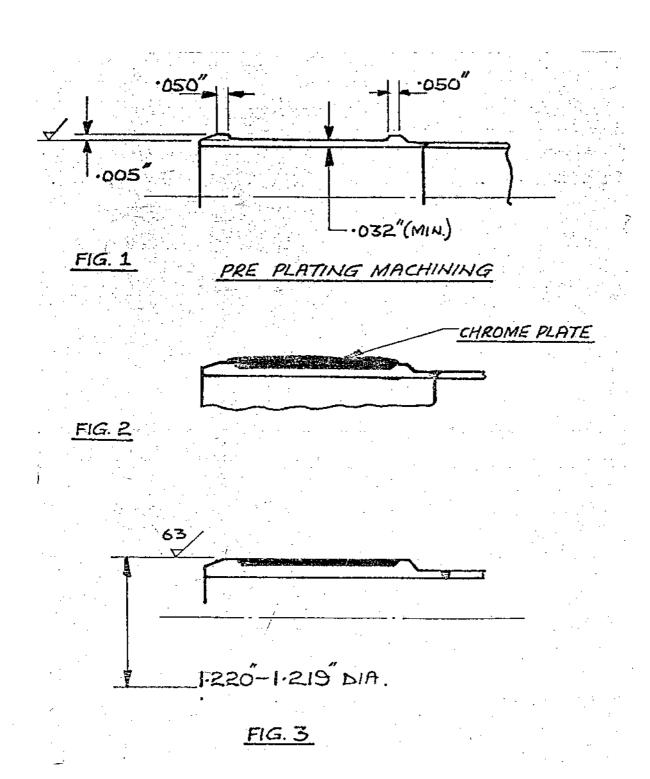
NOTE: If .032" minimum wall thickness cannot be maintained, Repair to Part 2.

PART 2. REPAIR BY REPLACING TUBE END.

- Part off section of tube B427746 approx. 1.850" from end face of B427745 (discard damaged section of tube, and end fitting B427745).
- 2. Prepare location and pipe joint B499408 ND for welding as per the Overhaul Manual.
- 3. Assemble pipe joint with tube, and Argon Arc weld in position.
- 4. Adjust length of pipe joint to produce unit overall length with Ferrule B427745 welded in position.
- 5. Heat treat at 650° ± 5°C for one hour. Cool in air.
- 6. Visual inspect.
- 7. Fluorescent penetrant inspect to Overhaul Manual.
- Radiographic (X-ray) inspection.
- 9. Pressure test tube to 100 lbs/sq.in. using water for a minimum of 15 seconds. No leakage permitted.
- 10. Final inspect.

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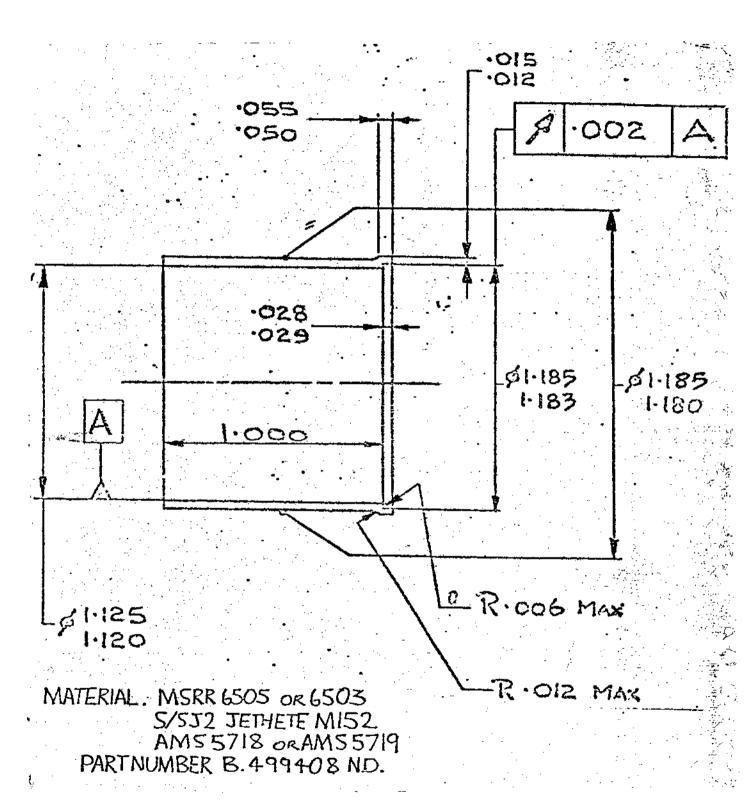
TEMPORARY REVISION No. 72-529



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CONCORDE

TEMPORARY REVISION No. 72-529





LH ACCESSORY GEARBOX CASE - REPAIR

TABLE OF CONTENTS

| Repair No. | R | ep | а | i | r | No | |
|------------|---|----|---|---|---|----|--|
|------------|---|----|---|---|---|----|--|

1

Restoration of gearbox case faces and bosses by electroless nickel plating and by fitting liners. SAL.B.502620-5

2

Ring, Assembly, Coupling. Worn location faces restored by plasma spraying. SAL.B.516649

Printed in England



LH GEARBOX CASE ASSEMBLY - RESTORATION OF FACES AND BORES BY ELECTROLESS NICKEL PLATING OR FITTING LINERS

MODIFICATION No. 0L.8868C

1. Effectivity

| I.P.C. | <u>Fig./Item</u> | Part No. |
|----------|------------------|----------------------------------|
| 72-62-01 | 8 10 | B.933873 B.933880 B.933881 |
| | | B-933882 |

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the LH gearbox case faces and bores by electroless nickel plating or by fitting liners.
- (2) Dimensions are shown thus: INCHES (MILLIMETRES) in tables and illustrations.
- (3) Refer to Chapter 72-09-00 Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micro-metres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.5.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.

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Repair No.1
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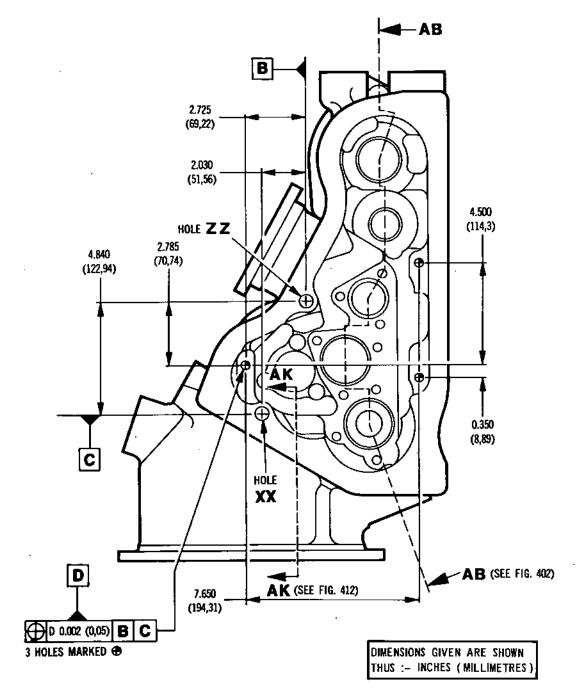
- B. Repair Limitations.
 - (1) The schemes listed in Table 401 may be used in any suitable combination to effect a repair of the case assembly.
 - (2) When plating schemes are used in combination, premachine all locations so that only one immersion in the process tanks is required.
 - (3) When fitting liners, machine all locations and fit all liners at the same time, so that only one heat curing stage is required for the bonding agent.

| Salvage No. | Repair |
|-------------|-------------------------------|
| B.502620 | Bores B,C,D - plating |
| B.502621 | Diaphragm face - plating |
| B.502622 | Flanged pin location - liners |
| B.502623 | Bores B,C,D - Liners |
| B.502624 | Oil pump bearing - plating |
| B.502625 | Oil pump bearing - liners |

Salvage Number Identification Table 401

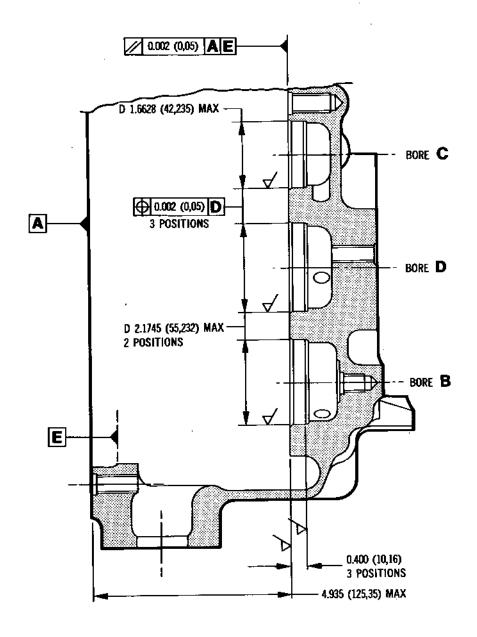
3. <u>Instructions</u>

- A. General.
 - (1) Inspect the case assembly to identify the repairs required.
 - (2) Blank all oilways.
- B. Salvage B.502620 Restoration of Bores B,C,D by Plating (Ref. Figs. 401 to 405).
 - (1) Ensure that all inserts are 0.010 in. (0,25 mm) minimum below the surface to be machined. Remove any inserts less than 0.010 in. (0,25 mm) below the surface.



LH Accessory Gearbox Case Assembly Main Datums Figure 401

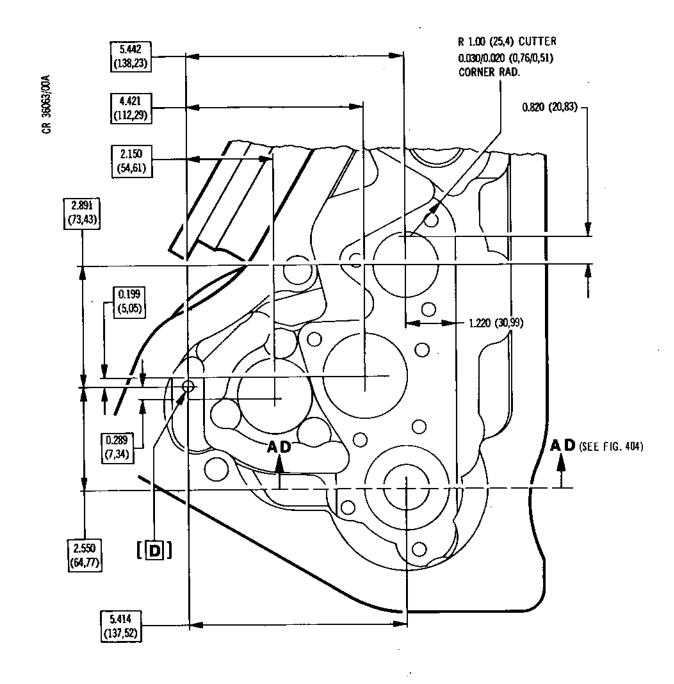
REPAIR 72-62-01 Repair No.1 Page 403 Dec 1/86



PART SECTION AB-AB
(SEE FIG. 401)

Pre-plating Dimensions Figure 402

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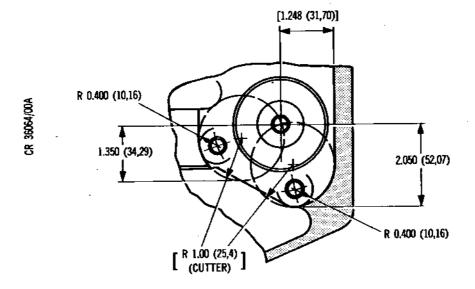


DIMENSIONS GIVEN ARE SHOWN Thus :- inches (Millimetres)

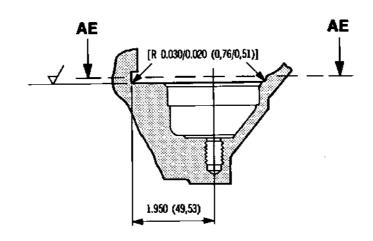
> Bore Centres Figure 403

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SECTION AE-AE

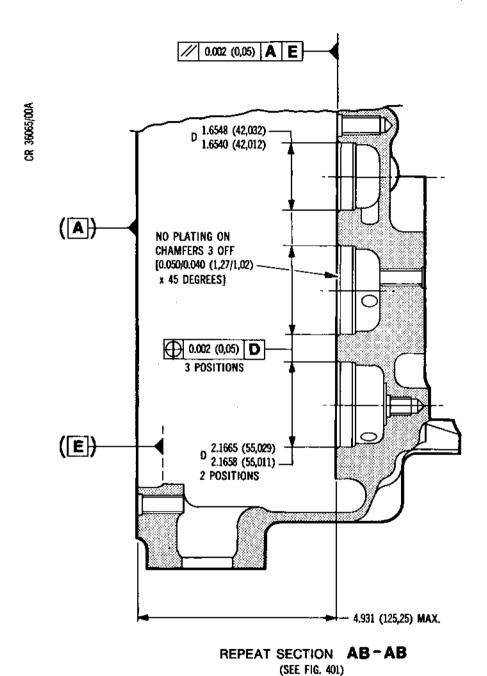


SECTION AD-AD (SEE FIG. 403)

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Facing Dimensions Figure 404

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Post-plating Dimensions Figure 405

DIMENSIONS GIVEN ARE SHOWN Thus :- Inches (Millimetres)

> 72-62-01 Repair No.1 Page 407 Dec 1/86

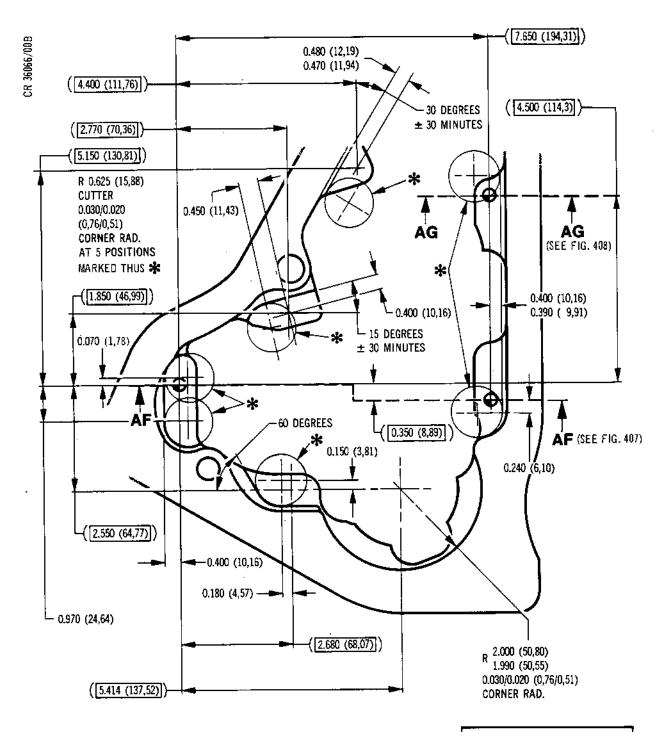


- (2) Machine the case assembly to remove fretting and distortion, removing the minimum amount of material (Ref.Figs.401 to 404).
- (3) Remove burrs and sharp edges.
- (4) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
- (5) Nickel plate the areas previously machined, to the dimensions given in Figure 405, using electroless nickel plating as specified in Chapter 72-09-17 Repair.
- (6) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
- (7) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
- C. Salvage B.502621 Restoration of Diaphragm Face by Plating (Ref. Figs. 401, 406, 407).
 - (1) Ensure that all inserts are 0.010 in. (0,25 mm) minimum below the surface to be machined. Remove any inserts less than 0.010 in. (0,25 mm) below the surface.
 - (2) Machine the case assembly to remove fretting and distortion, removing the minimum amount of material (Ref.Fig.406).
 - (3) Remove burrs and sharp edges.
 - (4) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
 - (5) Nickel plate the areas previously machined, to the dimensions given in Figure 407, using electroless nickel plating as specified in Chapter 72-09-17 Repair.



- (6) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
- (7) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
- D. Salvage 8.502622 Restoration of Flanged Pin Locations by Fitting Liners (Ref. Figs. 401, 406, 408, 416).
 - (1) Machine the flanged pin locations to the correct size (Ref.Fig.408).
 - (2) Remove burrs and sharp edges.
 - (3) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
 - (4) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
 - (5) Withdraw 3 off Liners B.502630 from stores.
 - (6) Apply Eccobond 104 to the liners and the three location holes, and assemble the liners to the three flanged pin locations, as specified in T\$D594-707B.
 - (7) Machine the liners to the dimensions given in Figure 408.
 - (8) Remove burrs and sharp edges.
 - (9) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
 - (10) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.

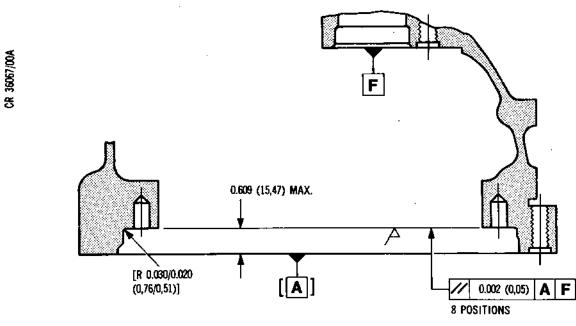




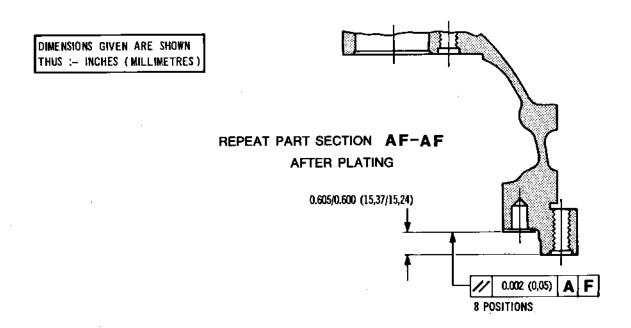
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Diaphragm Face Machining Figure 406

72-62-01 Repair No.1 Page 410 Jun 1/88

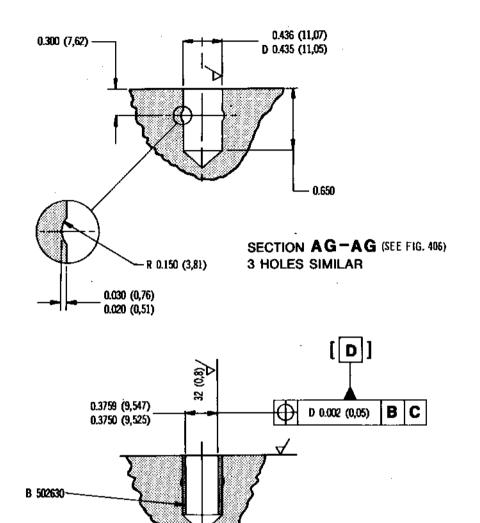


SECTION AF-AF (SEE FIG. 406)
PRE-PLATING



Restoration of Diaphragm Face Figure 407

72-62-01 Repair No.1 Page 411 Dec 1/86 CR 36068/00A



SURFACE ROUGHNESS, VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN
THUS :- INCHES (MILLIMETRES)

REPEAT SECTION AG-AG

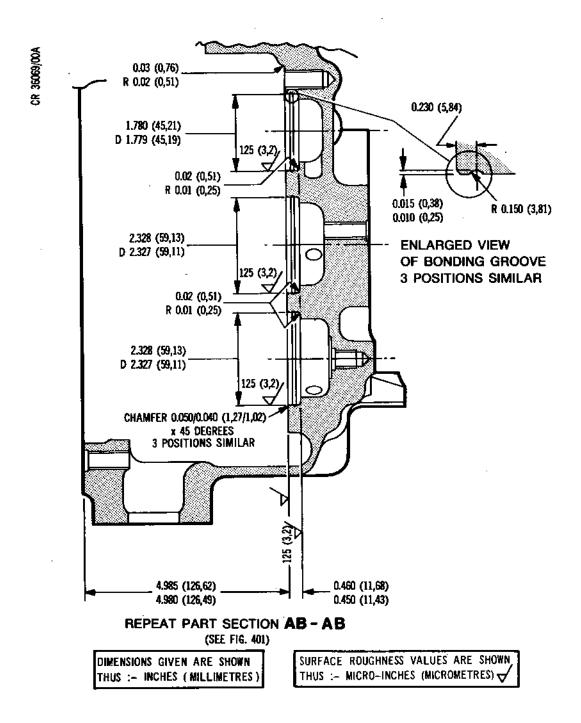
Restoration of Flanged Pin Locations Figure 408

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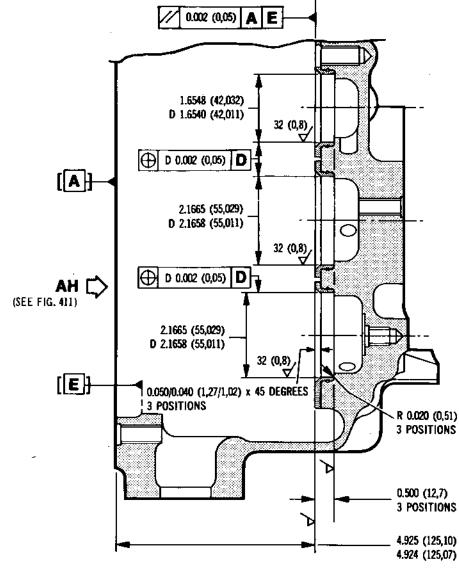
- E. Salvage B.502623 Restoration of Bores B,C,D by Fitting Liners (Ref.Figs.401, 403, 404, 409 to 411, 417 to 419).
 - (1) Remove all inserts from the face to be machined.
 - (2) Machine bores B,C,D and the faces as shown in Figure 409.
 - (3) Remove burrs and sharp edges.
 - (4) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
 - (5) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
 - (6) Withdraw from stores 1 off each liners B.502631, B.502632 and B.502633.
 - (7) Apply Eccobond 104 to the liners and the previously machined bores B,C and D and assemble the liners to the positions shown in Figure 411, as specified in TSD 594-707B.
 - (8) Machine the liners and faces to the dimensions given in Figure 410.
 - (9) Remove the burrs and sharp edges.
 - (10) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
 - (11) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.





Machining Details - Bores B,C and D Figure 409

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REPEAT SECTION AB-AB (SEE FIG. 401)

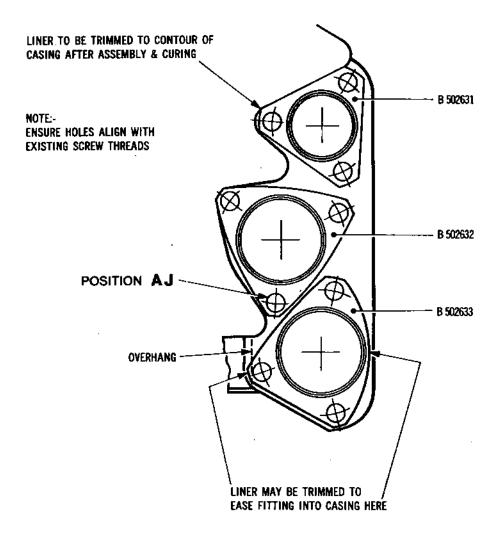
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Final Machining Details - Bores B,C and D Figure 410

REPAIR

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NOTE:- SKIM FACES OF LINERS TO DIMENSIONS SHOWN IN FIGURES 404 AND 410

VIEW IN DIRECTION OF ARROW **A H**(SEE FIG. 410)

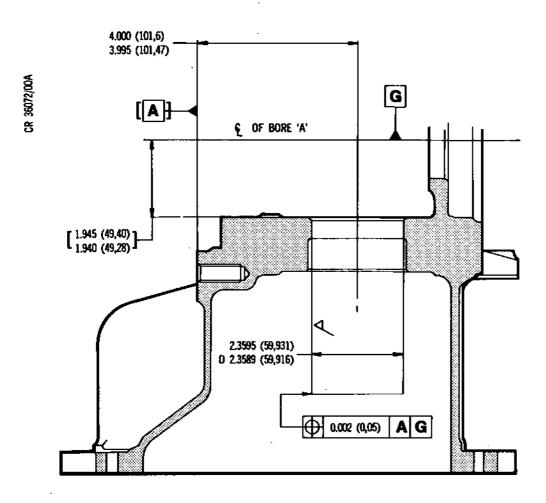
Assembly of Liners - Bores B,C and D Figure 411

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- F. Salvage B.502624 Restoration of Oil Pump Drive Location by Plating (Ref. Figs. 401, 412, 413).
 - (1) Machine the case assembly to remove fretting and distortion, removing the minimum amount of material (Ref. Fig. 412).
 - (2) Remove burrs and sharp edges.
 - (3) Crack test the case using the fluorescent dye penetant process specified for this component in Chapter 72-62-00 Inspection/Check.
 - (4) Nickel plate the area previously machined, to the dimensions given in Figure 413, using electroless nickel plating as specified in Chapter 72-09-17 Repair.
 - (5) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
 - (6) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
- G. Salvage B.502625 Restoration of Oil Pump Drive Location by Fitting a Liner (Ref. Figs. 401, 414, 415, 420).
 - (1) Machine the case assembly to the dimensions given in Figure 414.
 - (2) Remove burrs and sharp edges.
 - (3) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.
 - (4) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
 - (5) Withdraw from stores 1 off liner B.502634.



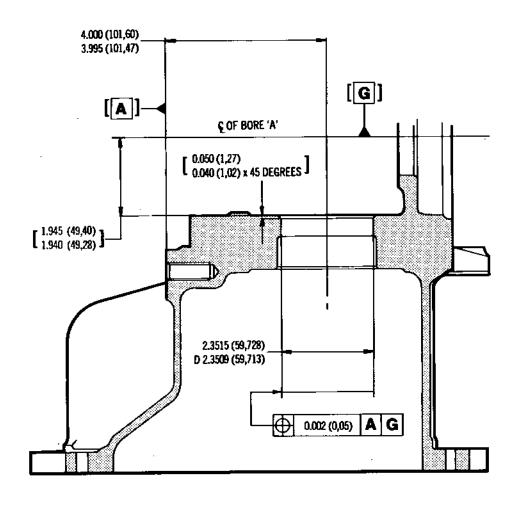


SECTION AK-AK (SEE FIG. 401)

DIMENSIONS GIVEN ARE SHOWN Thus :- Inches (Millimetres)

Pre-Plating Dimensions Figure 412

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REPEAT SECTION AK-AK (SEE FIG. 401)

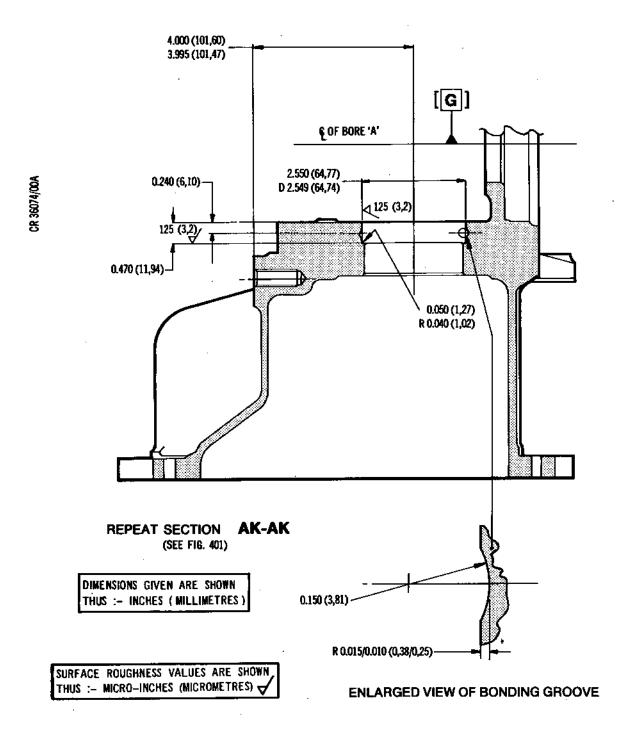
DIMENSIONS GIVEN ARE SHOWN THUS: - INCHES (MILLIMETRES)

Post-Plating Dimensions Figure 413

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Machining Dimensions - Bore A Figure 414

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CR 36075/00A

4.000 (101,6) 3.995 (101,47) [G] [**A**] € OF BORE 'A' 0.050 (1,27) 0.040 (1,02) x 45 DEGREES 32 (0,8) 1.945 (49,40) 1.940 (49,28) B 502634 **⊲**32 (0,8) 2.3515 (59,728) D 2.3509 (59,713) 0.002 (0,05) G

REPEAT SECTION AK-AK
(SEE FIG. 401)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

DIMENSIONS GIVEN ARE SHOWN Thus :-- INCHES (MILLIMETRES)

Final Machining Dimensions - Bore A Figure 415

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- (6) Apply Eccobond 104 to the liner and the previously machined bore A, and assemble the liner as shown in Figure 415, as specified in TSD 594-707B.
- (7) Machine the liner to the dimensions given in Figure 415.
- (8) Remove the burrs and sharp edges.
- (9) Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.
- (10) Crack test the case using the fluorescent dye penetrant process specified for this component in Chapter 72-62-00 Inspection/Check.

4. Final Assembly - All Repairs

- A. Assemble Solid Inserts.
 - (1) Obtain an interference fit of 0.002/0.000 in. (0,05/0,00 mm) by selective assembly from the following range:

B.485902-6 B.435757-61 (position AJ Fig.411)

Apply jointing compound Hylomar PL32 before assembly. Assembled inserts are to be 0.005 in. (0,13 mm) minimum below the surface.

- B. Assemble Wire Thread Inserts.
 - (1) Apply jointing compound Hylomar PL32 to the tapped hole, and assemble locking inserts AG\$3782 until 1/1.5 turns below the surface (Ref.72-09-00 Repair).
- C. Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-02 Repair.



- D. Mark SAL B.502620 to B.502625 as appropriate, adjacent to the part number. Use vibro-percussion marking (Ref.72-09-00 Repair).
- E. Apply Alocrom 1200 locally to protect the case, as specified in Chapter 72-09-00 Repair.
- F. Remove blanks from oilways.
- 5. Special Tools, Fixtures and Equipment

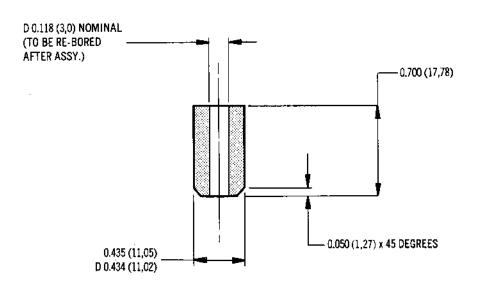
None.

Replacement Parts

| Description | <u>Qty</u> | Part No. | <u>IPC Ref</u> | <u>Fig.</u> |
|-------------|------------|----------|----------------|-------------|
| Liner | 3 | B.502630 | _ | 416 |
| Liner | 1 | B.502631 | _ | 417 |
| Liner | 1 | 8.502632 | _ | 418 |
| Liner | 1 | B.502633 | - | 419 |
| Liner | 1 | B.502634 | - | 420 |

NOTE: The above parts may be manufactured by the customer.

36076/00

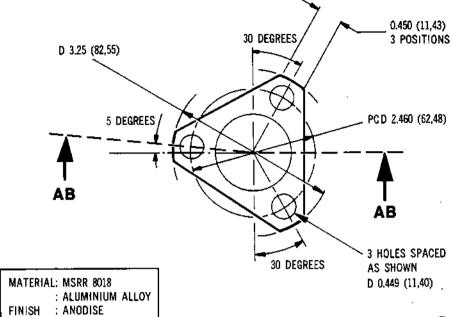


DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

MATERIAL: MSRR 6616 CORROSION RESISTANT STEEL SURFACE TEXTURE 125 (3,2)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

Liner - Flanged Pin Location Figure 416 PRINTED IN ENGLAND



0.100 (2,54)

0.100 (2,54)

0.100 (2,54)

0.020 (0,51) x 45 DEGREES MIN.

0.030 (0,76)

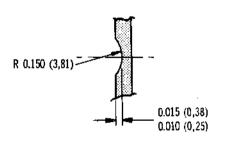
R 0.020 (0,51)

0.440 (11,18)

0.430 (10,92)

AC

SECTION AB-AB



ENLARGED VIEW AT AC

SURFACE TEXTURE 125 (3,2)

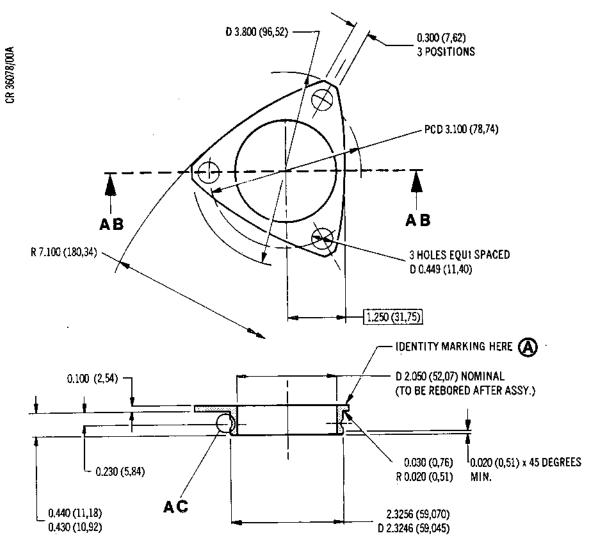
SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

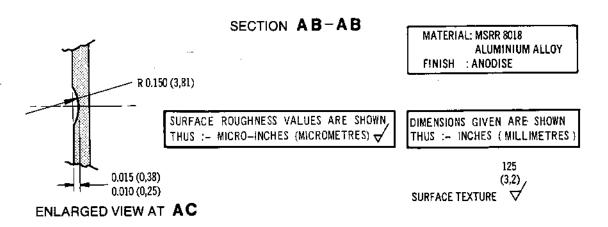
DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Liner - Bore C Figure 417

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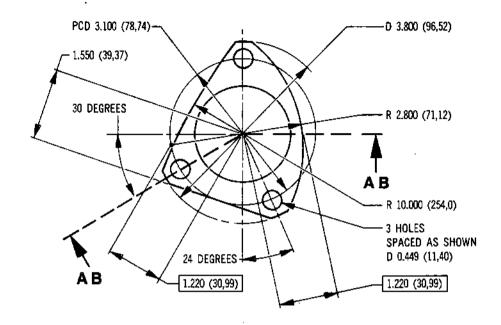


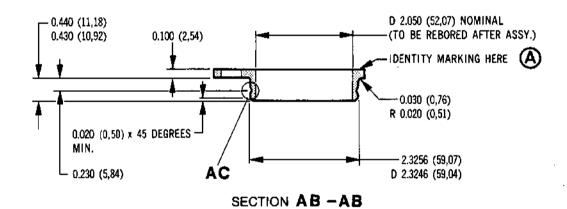


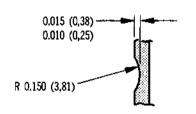


Liner - Bore D Figure 418

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ENLARGED VIEW AT AC

SURFACE TEXTURE 125 (3,2)

MATERIAL: MSRR 8018 ALUMINIUM ALLOY

FINISH : ANODISE

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES) \checkmark

Liner - Bore B Figure 419

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DENTITY MARKING (64,709)
D 2.5466 (64,683)

0.020 (0,51) x 45 DEGREES

0.030 (5,84)

D 2.000 (50,8)

NOM!NAL (TO BE REBORED AFTER ASSY.)

SURFACE TEXTURE 125 (3,2)

SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES)

MATERIAL: MSRR 8018

ALUMINIUM ALLOY FINISH : ANODISE

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

R 0.150 (3,81)

ENLARGED VIEW AT AB

Liner - Oil Pump Drive Bearing Figure 420

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RING, ASSEMBLY, COUPLING

WORN LOCATION FACE RESTORED BY PLASMA SPRAYING

B516649

1. EFFECTIVITY

IPC Fig./Item

Part No.

72-62-01

2/60A

B450731

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Instruction may be applied any number of times provided the minimum pre-spray dimensions can be maintained (refer Section AA Fig. 402).

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO 1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO 1302 (JES137)
Surface texture to be 125 Microinches (3,2 Micrometres)
Welding symbols to ISO 2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

NOTE: OPERATIONS 1 TO 3 ARE FOR REPEAT REPAIRS ONLY, FOR NEW REPAIRS PROCEED TO OPERATION 4.

 Completely remove all traces of coating from area XX by chemical stripping, or machining. Refer TSD 594 OP.107 APP.1. Refer Figs.401 and 402.

 Locally etch repair area to ensure complete removal of coating. Refer TSD 594 0P.214

REPAIR

/2-62-01 Repair No. 2 Page 401 Jan 31/95 3) Locally dye penetrant inspect Refer TSD 594 OP.213 repair area.

NOTE: OPERATIONS 4 TO 6 ARE FOR NEW REPAIRS ONLY, FOR REPEAT REPAIRS PROCEED TO OPERATION 7.

4) Locate component to machine Refe and set true to datum.

Refer Figs. 401 and 402.

5) Machine defective location face to remove fretting. Remove minimum amount of material.

Refer Fig. 402.

6) Locally dye penetrant inspect repair area.

Refer TSD 594 0P.213

7) Mask off all areas except areas marked XX.

Refer TSD 594 OP.704 Refer Fig.402.

Abrasive blast area marked XX.

Refer TSD 594 OP.704 Refer fig.402.

9) Plasma spray coating on area marked XX. Apply coating to a sufficient thickness to achieve final dimensions. Refer TSD 594 OP.704 Use powder OMat 3/188. Refer figs.402 and 403.

- 10) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.
- 11) Remove masking.
- 12) Locate component to machine and set true to datum.

Refer Figs. 401 and 403.

13) Finish machine plasma coating to dimensions shown.Overspray to be removed.

Refer Fig.403.

- 14) Visually inspect coating for evidence of blistering, lifting, cracking or chipping.
- 15) Dimensionally inspect.

Refer Fig. 403.

72-62-01 Repair No. 2

REPAIR

Page 402 Jan 31/95 MK.610-14-28 snecma OVERHAUL

16) Mark Repair Instruction number RI B516649 or R2 and coating identity symbol on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

Coating symbol HA

5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u>

RR CODE

RING, ASSEMBLY, COUPLING

STAINLESS STEEL

S62

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

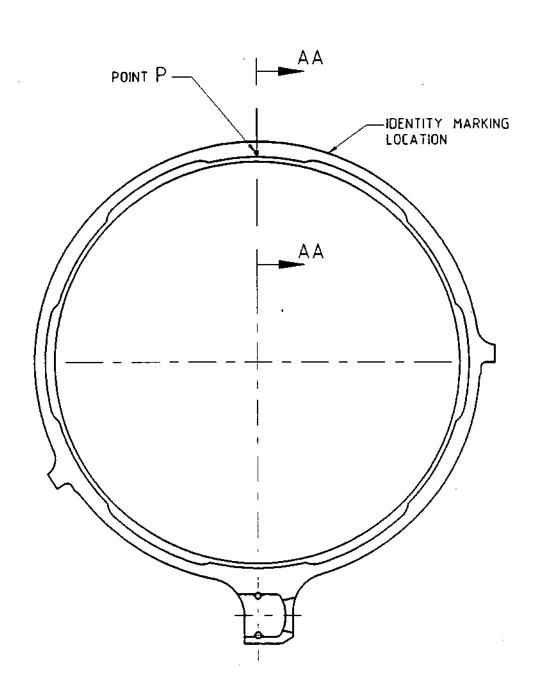
PART NUMBER DESCRIPTION

QUANTITY

ITEM

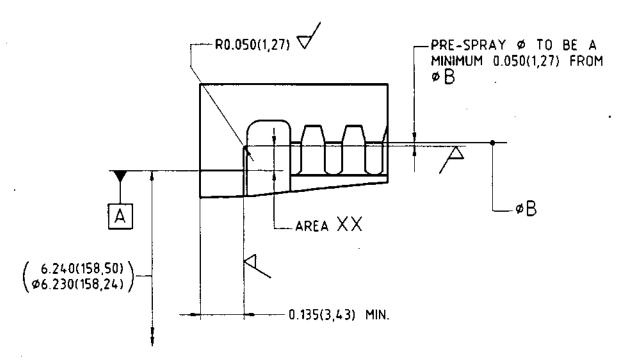
NONE.





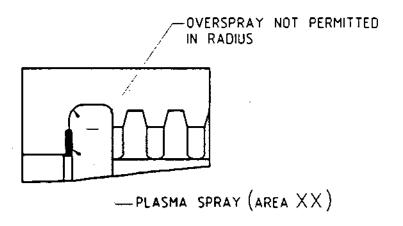
GENERAL VIEW ON COMPONENT FIG. 401.

REPAIR
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Printed in England

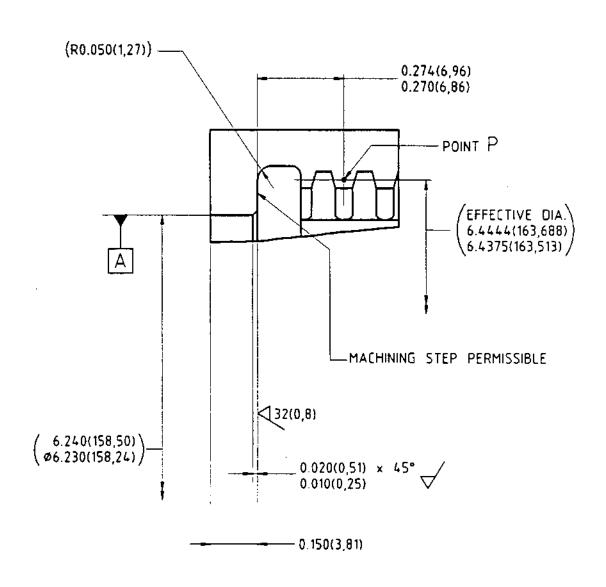
SECTION AA
PRE-SPRAY MACHINING DIMENSIONS



SECTION AA
PLASMA SPRAY REQUIREMENTS

FIG.402.

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SECTION AA

FINAL MACHINING DIMENSIONS FIG. 403.

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LEFT-HAND ACCESSORY GEARBOX MAIN DRIVES - REPAIR

TABLE OF CONTENTS

Repair No.

1

Title

Scheme No.

Gearshaft Spur. Removal of corrosion SAL.B.514856 pitting in undercut location by

machining



GEARSHAFT, SPUR

REMOVAL OF CORROSION PITTING IN UNDERCUT LOCATION BY MACHINING

REPAIR NO. B514856

1. <u>EFFECTIVITY</u>

| <u>IPC</u> | Fig./Item | <u>Part No.</u> |
|------------|-----------|--------------------|
| 72-62-02 | 1 /138A | B492788 B493057 |
| | 1 /138B | B493054 B493055 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This component forms part of a matched set. Ensure items are temporarily identified and remain together throughout this repair procedure.

This repair may be embodied any number of times provided stated dimensions are maintained (refer Fig. 402).

The repair area of this component is not normally exposed during routine Overhaul and Maintenance. For all other requirements, ref to SB.OL.593-72-90.

Temporary re-protection of components between operations should be carried out in accordance with TSD 594 OP 340.

GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR 72-62-02 Repair No. 1 Page 401 Jan 4/93



| 4. | REPATR | PROCEDURE | |
|----|--------|-----------|--|
| 4. | KELWTK | FROCEDORE | |

SUPPLEMENTARY INFORMATION

 Load component on to a lathe and set true to datums. Refer to Fig. 401.

2) Machine to remove corrosion deposits. Remove minimum material. Note: Tt is permissible to Refer to Figs. 401 and 402.

Note: Tit is permissible to machine surfaces C and D to remove any machining steps.

3) Locally crack detect.

Refer Overhaul Manual Chapter 72-62-00 Inspection/Check. NB. M.P.I. operations 1,2 and 5 only are required.

4) Clean gearshaft.

Refer Overhaul Manual Chapter 72-62-02 Cleaning.

5) Mark Repair Instruction number RI B514856 or R1 adjacent to the normal 'assy of' number. Use the electro-chemical marking or vibro-percussion engraving techniques.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

GEARSHAFT, SPUR

\$.82

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER

DESCRIPTION

ITEM

NONE.

8. REPLACEMENT PARTS

PART NUMBER

DESCRIPTION

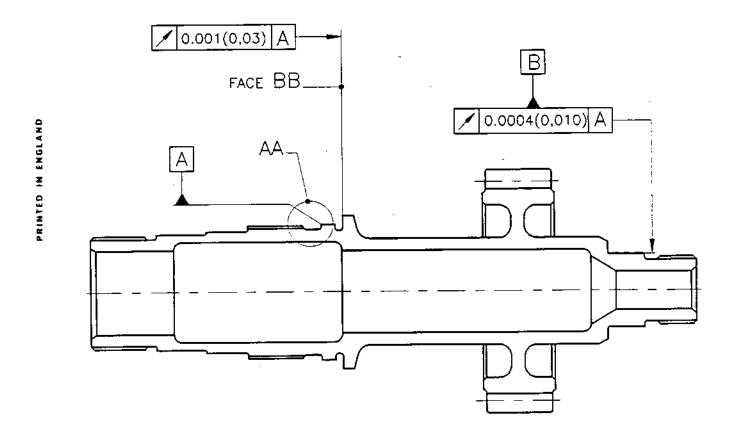
QUANTITY

ITEM

NONE.

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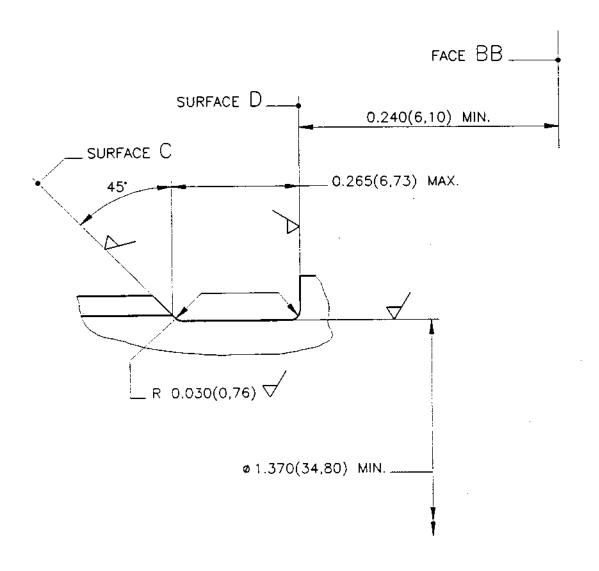




TYPICAL SECTION THROUGH GEARSHAFT, SPUR. FIG.401

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DETAIL AA FIG.402

REPAIR 72-62-02 Repair No. 1 Page 404 Jan 4/93



RH ACCESSORY GEARBOX CASE - REPAIR

TABLE OF CONTENTS

Repair No.

1

Restoration of Support Lug at the Integrated Drive Generator Flange by Welding SAL.B.495501

72-63-01 Contents 1 Apr 1/82



RH GEARBOX CASE - RESTORATION OF SUPPORT LUG AT THE INTEGRATED DRIVE GENERATOR FLANGE BY WELDING

MODIFICATION NO. OL.8560 AND 8742

1. <u>Effectivity</u>

| <u> I.P.C.</u> <u>Fig./</u> | | <u>Item</u> | <u>Part No.</u> |
|-----------------------------|----|-------------|--|
| 72-63 - 01 | 10 | 30A . | B.925519 B.925529 B.925530 B.925531 B.925533 B.925534 |
| , | | 30B 30C | B.925537 B.925901 B.928252 B.928253 |

2. Introduction

A. General.

- (1) This repair describes the procedure for restoring the support lug at the integrated drive generator flange by welding.
- (2) Dimensions are shown thus, INCHES (MILLIMETERS) in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (4) Remove sharp edges 0.004 to 0.020 in. (0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.

REPAIR



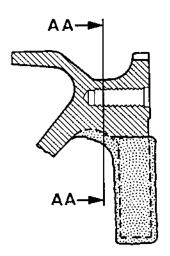
- (7) Surface texture is to be 125 micro-inches (3,2 micro-meters) in drilled holes and 63 micro-inches (1,6 micrometers) on machined surfaces unless otherwise stated.
- (8) Protect the component against corrosion after each operation and place in a container for protection against damage during transit between operations.

3. Instructions

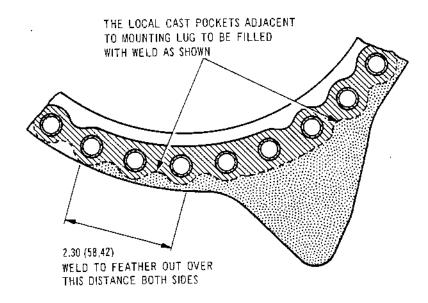
- A. Prepare Support Lug for Welding.
 - (1) Remove wire thread insert(s) AGS.3782 and solid insert(s) B.485902-6 from sealing face within 3.00 in. (76,2 mm) of area to be welded.
 - (2) Clean the area to be welded using Scotchbrite, then vapour degrease, or clean with a group 2, 3 or 4 solvent (Ref.72-09-00 - Cleaning). Ensure complete removal of any anodizing or Alocrom (Ref.Fig.401).
 - (3) Crack test the area to be welded using the fluorescent dye penetrant process specified for this component in Chapter 72-63-01, Inspection/Check.
 - (4) Inspect to ensure satisfactory weld preparation has been carried out.
- B. Build Up Support Lug With Weld.
 - (1) Pre-heat the case for 2 hours at 200°C.
 - (2) Completely weld build up support lug as shown at Fig.4D1; refer to para.6, process A, for welding data.
 - (3) Cool the case for 2 hours at 200°C.
- C. Dress Lug Contours.
 - (1) Locate template ref. tool item 1 to support lug.
 - (2) Dress to produce lug contours using conventional hand tools (Ref.Fig.402).

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CR 35835/00A



WELD BUILD UP WHERE SHOWN THUS

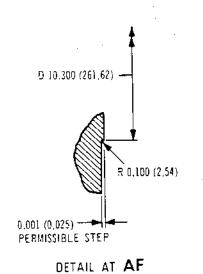


SECTION AA-AA

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Weld Build Up of Lug Figure 401

REPAIR
72-63-01
Repair No.1
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AF B

D 0.004 (0.102) A

AF B

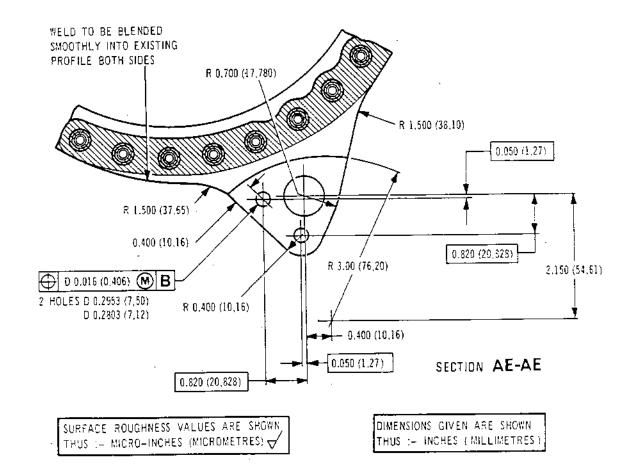
D 0.3762 (22,255)
D 0.375 (22,225)

R 0.080 (2,032)

AE 0.050 (1,270) X 45
0.040 (1,016) DEGREES

0.600 (15,240)

SECTION AB-AB (SEE FIG 464)



Gearbox Case Showing Lug Position Figure 402

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D. Inspect.

- (1) Inspect to ensure sufficient weld has been deposited to enable final machining dimensions to be obtained (Ref.Figs.401 and 402).
- (2) Inspect welded support lug to ensure no crater exists between weld and sealing surface (Ref.Fig.401).
- (3) Crack test the welded area using the fluorescent dye penetrant process specified for this component in Chapter 72-63-01, Inspection/Check.
- (4) Carry out a non-destructive radiological X-ray test of the welded area.

E. Heat Treat and Inspect.

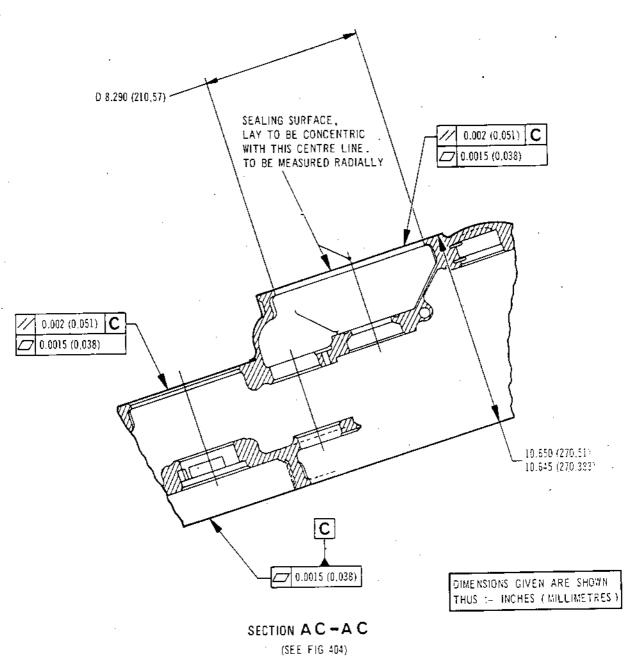
- (1) Precipitation heat treat the component to 215 deg.C plus/minus 5 deg.C for 16 hours. Cool in air.
- (2) Crack test the component using the fluorescent dye penetrant process specified for this component in Chapter 72-63-01, Inspection/Check.
- (3) Inspect case to ensure no distortion has been caused by the heat treatment.

F. Machine Case.

- (1) Locate case to jig boring machine on large end face. Clock case true using 8.290 in. (210,57 mm) diameter bore (Ref.Fig.403), and to vertical and horizontal centrelines (Ref.Fig.404).
- (2) Finish mill sealing surface side of support lug to produce 10.650 /10.645 in. (270,51/270,38 mm) dimension and blend with existing surface (Ref.Fig. 403). A step of 0.001 in. (0,25 mm) is permissible between re-machined area and existing sealing surface. Care must be taken not to damage the sealing surface.

REPAIR

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Gearbox Case Showing Sealing Surface Figure 403

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Repair No.1
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0.002 (0,0508) 3 HOLES WHERE MARKED **‡**EQUI-SPACED AS FOR 32
D 0.5632 (14,305)
D 0.5626 (14,290) EXISTING + SECTION AD-AD 2.620 (66,548) A C 5.60 (142,24) ΑD **AC** (SEE FIG 403) AB→ (SEE FIG 402) 11 DEGREES 37 MINUTES 30 SECONDS

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES)

Machining Dimensions Figure 404

REPAIR
72-63-01
Repair No.1
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- (3) Drill and ream the 0.875/0.8762 in. (22,22/22,25 mm) diameter hole (Ref.Fig.402) on the 2.620 in. (6,55 mm) and 5.600 in. (142,24 mm) co-ordinates (Ref.Fig.404). Chamfer the hole 0.040/0.050 at 45 degrees (Ref.Fig.402).
- (4) Drill and ream 2 holes 0.2803/0.2953 in. (7,12/7,50 mm) diameter in support lug (Ref.Fig.402).
- (5) Finish mill underside face of support lug to produce 0.600 in. (15,24 mm) flange thickness and 0.080 in. (2,03 mm) corner radius using a 6.000 in. (152,40 mm) diameter cutter on 2.150 in. (54,61 mm) and 0.400 in. (10,16 mm) co-ordinates (Ref.Fig.402).
- (6) Remove case from jig boring machine.
- (7) Produce 0.100 in. (2,54 mm) corner radius on underside of lug using conventional hand tools (Ref. Fig.402).
- G. Clean and Inspect.
 - (1) High power wash oil passages to ensure completely free from swarf and any other foreign bodies.
 - (2) Inspect to ensure weld repair and machining has been carried out satisfactorily and that all oil passages are clean.
 - (3) Crack test the machined area using the fluorescent dye penetrant process specified for this component in Chapter 72-63-01, Inspection/Check.
- H. Surface Treat Repaired Area.
 - (1) Locally surface treat the repaired area with Alocrom 1200 using the procedure detailed in Chapter 72-09-02, Repair.

J. Replace Inserts.

- (1) Replace any solid insert(s) removed at para.3.A.(1). An interference of 0.002/0.000 in. (0,05/0,00 mm) must be obtained by selective assembly of an insert from the range B.485902-6. All assembled insert(s) to be a minimum of 0.005 in. (0,13 mm) below the surface. Lubricate insert(s) using graphite grease (AeroShell Grease 8) to enable a torque interference reading of 100-300 lbf in. (11,3-33,9 Nm) to be obtained.
- (2) Inspect to ensure satisfactory assembly of solid insert(s).
- (3) Assemble wire thread insert(s) AGS.3782 to solid insert(s) 1 to 1-and-a-half turns below surface of counter-bore face of solid insert(s). Remove tang(s).
- (4) Inspect to ensure satisfactory assembly of wire thread insert(s) and removal of tang(s).
- K. Identify and Final View.
 - (1) Mark salvage number B.495501 or R1 adjacent the existing standard part number, using the vibropercussion engraving technique as specified in Chapter 72-09-00, Repair.
 - (2) Finally inspect the case to ensure the repair has been carried out satisfactorily and that the case is in a serviceable condition.
 - (3) Generally clean the case to remove grease and foreign bodies, then place in a protective container and store as required.

4. Special Tools, Fixtures and Equipment

| <u>Description</u> | Qty. | Tool No. | <u>Item No.</u> |
|--------------------|------|----------------|-----------------|
| Template | 1 | \$3\$.13634000 | 1 |

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Repair No.1
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5. Replacement Parts

Description

Qty.

Part No.

Solid Inserts

A/R

B.485902-6

Wire Thread Inserts

A/R

AGS.3782

Welding Data

A. Process A.

(1) Method of Welding:

Manual Argon Arc

(2) Machine:

B.O.C. Quasi-Arc

(3) Torch:

Mk.3 Water Cooled

(4) Current:

155-175 Amps at 110 Volts (A.C.)

(5) Electrode:

3/16 in. (4,76 mm) Thoriated

Tungsten

(6) Filler Wire:

0.092 in. (2,34 mm) diameter

MSRR 9500/34

(7) Argon to Torch:

18 cu.ft/hr. (9 litres/min)

(8) Backing:

None

(9) Weld for periods of half hour maximum until weld

build up complete.

(10) Base Material:

MSRR 8009



RH ACCESSORY GEARBOX MAIN DRIVES - REPAIR

TABLE OF CONTENTS

| Repair No. | Title | Scheme No. |
|------------|---|--------------|
| 1 | Right-Hand Accessory Gearbox Main Drives - Bearing Housing Sealing Face Restored by Plasma Flame | SAL.B.495548 |
| 2 | Housing Bearing. Provision for the Restoration of Sealing Face by Plasma Spray | SAL.B.513547 |

RH ACCESSORY GEARBOX MAIN DRIVES - REPAIR BEARING HOUSING SEALING FACE RESTORED BY PLASMA FLAME DEPOSITION

MODIFICATION NO.OL.8603C

1. Effectivity

| I.P.C. | <u> Fig./</u> | 'Item | Part No. |
|----------|---------------|-------|----------------------|
| 72-63-02 | 1 | 320B | B.454643 B.492627 |

2. Introduction

A. General

- (1) This repair describes the procedure for restoring the sealing face on the bearing housing, by plasma spray deposition.
- (2) Refer to 72-09-00, Repair, for all standard practices applicable to this repair procedure.
- (3) Remove all sharp edges 0.004 to 0.020 in. (0,10 to 0.51 mm) unless otherwise stated.
- (4) Tools referred to by item numbers are detailed in paragraph 4.
- (5) Consumable materials required to complete this repair are detailed in Table 401

3. Instructions (Ref. Fig. 401)

- A. Prepare Location for Plasma Spray Application
 - (1) Secure the holding fixture (Ref. tool item 1) to a centre lathe and attach the bearing housing to the fixture.
 - (2) Produce the recess to the 6.040 and 6.780 in. (153,41 and 172,21 mm) dimensions and form the corner radius (Detail A). Note that the approximate width of the recess is 0.740 in. (18,8 mm).



| MATERIAL AND SPECIFICATION | COLOUR | SUPPLIERS REF. | SUPPLIER |
|---|---------------|-------------------|--|
| Resin MSRR9142 | Clear (PL163) | 6965C800 | Internationa Pinchin Johnson, Transport Division, Rotton Park Street, Ladywood, Birmingham 1 |
| Tungsten carbide cobalt MSRR9507/1 | - | - | - |

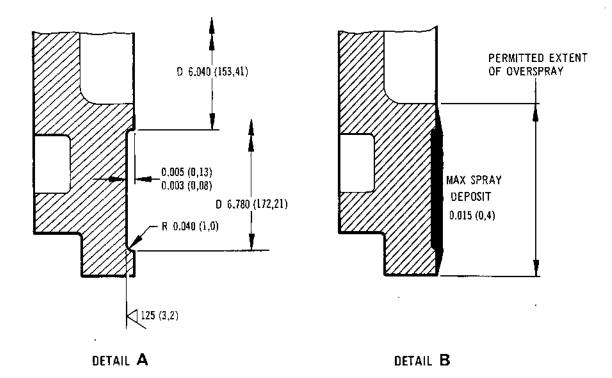
Consumable Materials Table 401

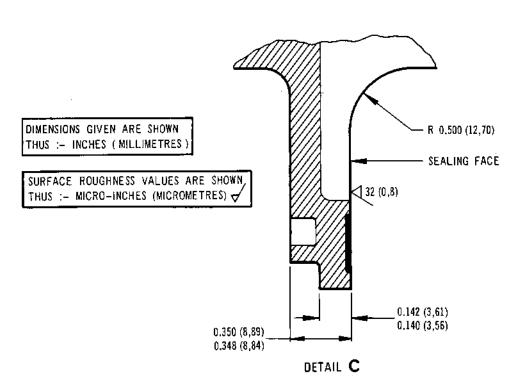
- (3) Remove sharp edges then remove the bearing housing from the fixture and inspect visually and dimensionally to ensure that the machining operation has been completed satisfactorily.
- (4) Inspect the bearing housing by the fluorescent dye penetrant crack detection method using the process recommended for this component in 72-63-00, Inspection/Check.
- (5) Mask all areas where plasma spray is not required (see Detail B).
- (6) Apply dry abrasive blasting treatment to the repair location in accordance with the procedure detailed in 72-D9-24, Repair.

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Repair No.1
Page 402
Feb 1/82



CR 35860/00A





Bearing Housing Repair Details Figure 401

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Repair No.1
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8. Apply Plasma Spray

- (1) Apply plasma spray to the repair location and prepared test piece.
 - (a) Use tungsten carbide cobalt to specification MSRR9507/1 in accordance with the procedure detailed in 72-09-11, Repair. Deposit sufficient thickness (max. 0.015 in (0,4 mm)) to allow for grinding to final dimensions (Details B and C).

C. Machine Repair Location

- (1) With the bearing housing located in the holding fixture (Ref. tool item 1) and the fixture mounted on an internal grinding machine equipped with a diamond wheel, finish grind the plasma spray to blend in with the existing face and maintain the 0.350/0.348 in. (8,89/8,84 mm) dimension (Detail C).
- (2) Check the sealing face for flatness. If sealing face is stepped, reset the machine, finish grind to remove step and blend with existing 0.500 in. (12,7 mm) radius.
- (3) Remove the bearing housing from the machine.
- (4) Dress and remove any surplus spray.
- (5) Visually and dimensionally inspect all previous operations.
- (6) Inspect the bearing housing by the fluorescent dye penetrant crack detection method using the process recommended for this component in 72-63-00, Inspection Check.

D. Apply Resin Sealing

- (1) Degrease the bearing housing in accordance with the procedure detailed in 72-09-00, Cleaning.
- (2) Mask all surfaces except the sealing face of the bearing housing (see Detail C).
- (3) Heat the bearing housing in an oven to 150 deg C and proceed immediately to apply resin to specification MSRR9142 as detailed in paragraph (4).





- (4) Resin sealing application.
 - (a) Apply the resin to the pre-heated component using a spray gun similar to an Aerograph type MPS with a number 2 "set up".

NOTE: A "set up" is a combination of needle, air valve and fluid tip.

- (b) Operate the spray gun at a pressure of 25 to 40 psi (170 to 275 kPa) and maintain the nozzle 8 to 12 in. (200 to 300 mm) from the work surface.
- (c) Spray the bearing housing sealing face with one coat to a thickness of 0.0004 to 0.0008 in. (0,010 to 0,020 mm).
- (5) Visually inspect for satisfactory coverage then remove masking.
- E. Identify
 - (1) Mark SAL.B.495548 or R1 next to the existing part number using the electro-chemical or vibro percussion marking technique detailed in 72-09-00, Repair.
- F. Finally Inspect

Finally inspect the repair and check that the bearing housing is serviceable.

4. Special Tools Fixtures and Equipment

| <u>Description</u> | <u>Qty</u> | Tool No. | <u>Item</u> |
|--------------------|------------|---------------|-------------|
| Holding Fixture | 1 | \$38.15551000 | 1 |

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HOUSING BEARING

PROVISION FOR THE RESTORATION OF SEALING FACE BY PLASMA SPRAY REPAIR NO. 8513547

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-63-02

01 3208

B492627

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

The maximum repairable dimension AC (Refer fig 402) must not exceed 0.125 (3,18).

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Locate component on a centre lathe and set true to diameter AB and datum B. Machine the pre spray groove to the dimensions shown.
- Refer fig 402

2) Crack detect repaired area.

Refer Overhaul Manual Chapter 72-63-00 Inspection/Check.

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3) Dimensionally inspect.

4) Mask off areas not to be coated and plasma spray face AD to a max. thickness of 0.020 (0,51).

5) Visually inspect coating for defects.

6) locate component on a centre lathe and set true to diameter AB and datum B. Machine the groove to the post spray dimensions shown. Note: Any coating overspray to be removed by machining.

7) Dimensionally inspect.

8) Visually inspect coating for defects.

9) Mark on SAL B513547 or R2 and coating symbol HC adjacent to existing part number, using vibro-percussion engraving.

5. MATERIAL

COMPONENT

MATERIAL

HOUSING BEARING

Ti ALLOY **BSEM 646** Refer fig 402

Refer fig 403 Refer TSD 594-704 using MSRR 9507/14 (Metco 443).

Refer TSD 594-704 Section 8.

Refer fig 404

Refer fig 404

Refer TSD 594-704 Section 8.

Ref Overhaul Manual Chapter 72-09-00 Repair.

RR CODE

6. DATA

NONE.

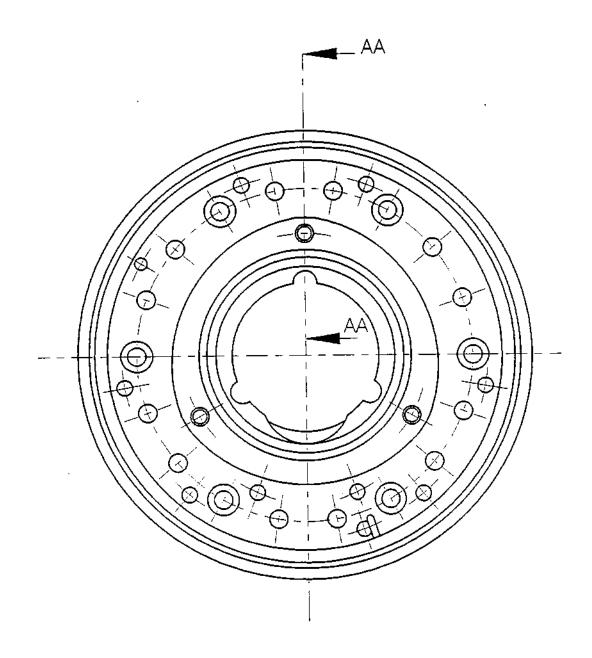
7. <u>TOOLS</u>

NONE.

8. REPLACEMENT PARTS

NONE.

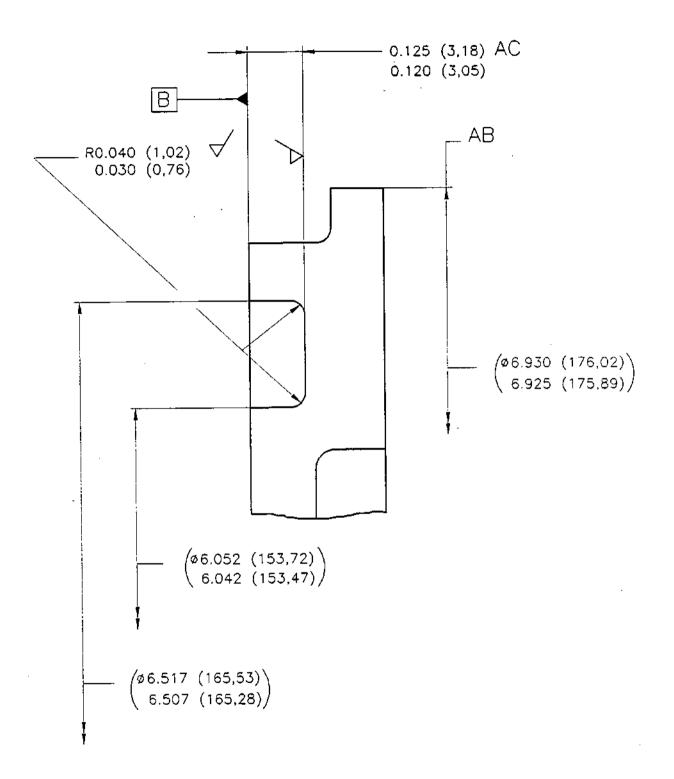
REPAIR Page 402 Dec 1/91



GENERAL VIEW OF BEARING HOUSING FIG.401

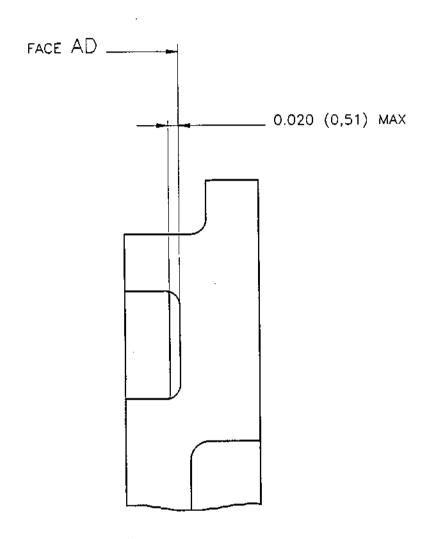
72-63-02 Repair No.2 Page 403 Dec 1/91





SECTION AA FIG.402

72-63-02 Repair No.2 Page 404 Dec 1/91



REPEAT SECTION AA SHOWING PLASMA SPRAY DETAILS FIG.403

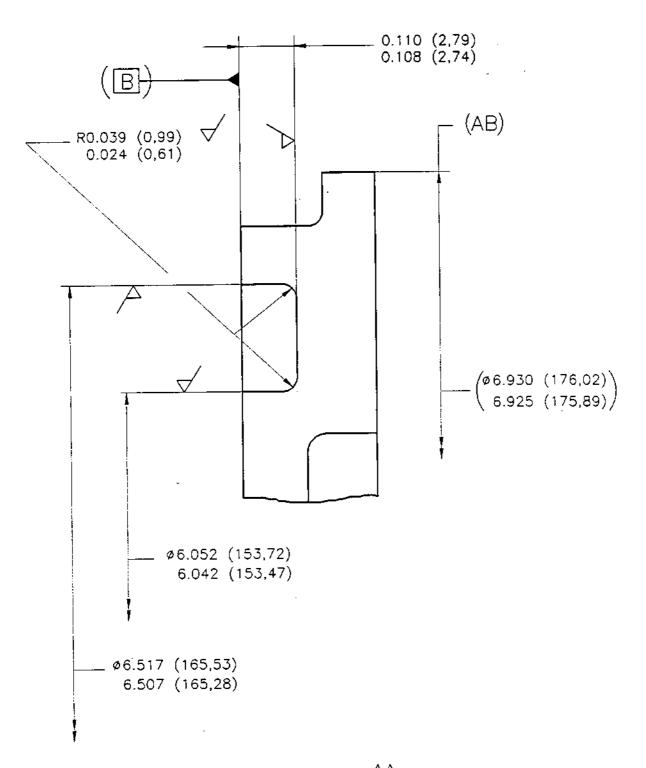
72-63-02

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REPEAT SECTION AA
SHOWING FINAL MACHINING DETAILS
FIG. 404

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BRITISH AIRWAYS

ATP TEMPORARY REVISION

CONCORDE
OLYMPUS 593
OVERHAUL MANUAL

TR Page 1 of 3 18 March 1992

This Temporary Revision complies with BCAR Chapter A5-3,B5-3 and/or TSS No.0-2 as appropriate.

for Chief Engineer (Technical & Quality Services) CAA Design Approval No.
DAI/8566/78

TEMPORARY REVISION NO 72-595

Insert in 72-63-02 at rear of repair section in RST No. order.

REASON FOR REVISION

- 1. To introduce a repair scheme to restore sealing face by plasma coating to R.H. gearbox bearing housing P/N's B484277 and B492627 (MRA 132).
- 2. To align TR 72-550 with manufacturers Revision No. 86.

ACTION

B.E.O.L. REPAIR

RST 4035 BEARING HOUSING: R.H. GEARBOX:- RESTORE SEALING FACE BY PLASMA COATING.

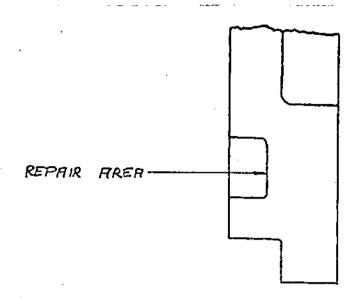
PROCEDURE

- 1. Set running true. Machine to prespray dimensions in Fig. 1.
- 2. Prepare machined surface for plasma coating as per T.S.D. 594 704.
- 3. Plasma spray repair area using MSRR 9507/14 (Metco 443) powder, in accordance with, T.S.D. 594 704. To dimensions shown in Fig.2.
- 4. Inspect plasma for cracks and adhesion of coating, as per T.S.D. 594 704.
- Machine surface as per Fig. 3.
- 6. Inspect as per Op.4.
- Dimensionally inspect.
- 8. Vibro engrave RST 4035 adjacent to P/N.
- The above is written in accordance with OLY/SEDP/908.

Originator: TIS Work Record: 72-6

BRITISH AIRWAYS

CONCORDE
OLYMPUS 593 OVERHAUL MANUAL
TEMPORARY REVISION NO 72-595 (Cont'd)



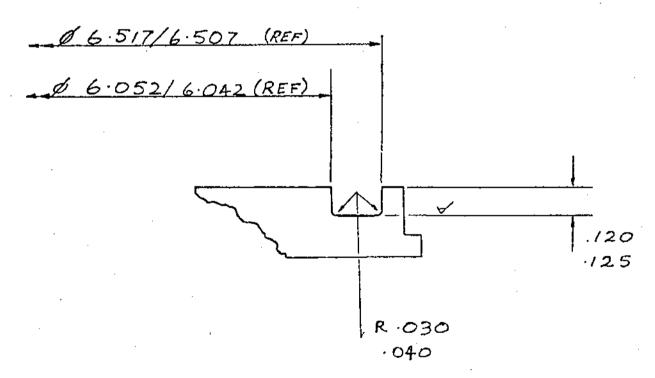
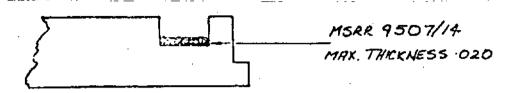


FIG. 1.

CONCORDE
OLYMPUS 593 OVERHAUL MANUAL
TEMPORARY REVISION NO 72-595 (Cont'd)



F (G. 2

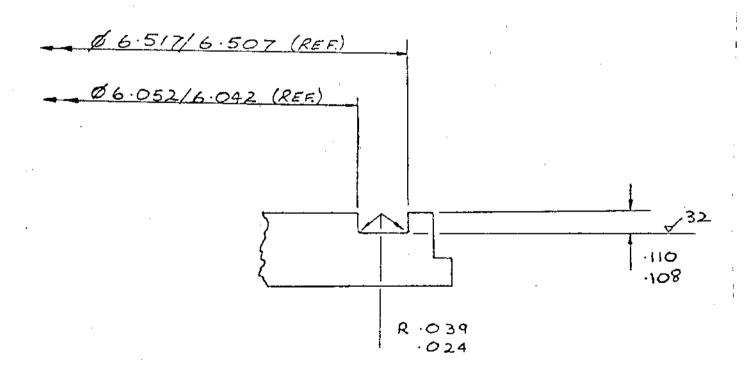


FIG. 3



RH GEARBOX HYDRAULIC PUMP DRIVES

TABLE OF CONTENTS

Repair No.

Title

Scheme No.

1

Restoration of Sealol seals and mating rings by blending and lapping B510619-20



RH GEARBOX CASE ASSEMBLY - REPAIR BY BLENDING AND LAPPING TO REMOVE DAMAGE TO SEALOL SEALS AND MATING RINGS

MODIFICATION No. 0L.8904C

1. Effectivity

| I.P.C. | Fig./Item | <u>Part No.</u> |
|-------------------|------------------------|-------------------------------|
| 72-63 - 05 | 1 70, 150 1 90, 170 | B.431317,B.494572 B.431318 |

Introduction

A. General.

- (1) This repair describes the procedure for restoring Sealol seals and their mating rings by lapping the seal faces and blending light damage.
- (2) Dimensions are shown thus, INCHES (MILLIMETRES), in tables and illustrations.
- (3) Refer to Chapter 72-09-00, Repair, for all standard practices applicable to this repair.
- (4) Remove sharp edges 0.004 to 0.020 in.(0,10 to 0,51 mm) unless otherwise stated.
- (5) Tolerances on machined dimensions are plus/minus 0.010 in. (0,25 mm) unless otherwise stated.
- (6) Tolerances on all angles are plus/minus 2 degrees unless otherwise stated.
- (7) Surface texture is to be 125 micro-inches (3,2 micrometres) unless otherwise stated.
- (8) All tools referred to by item number in procedural steps are detailed in para.4.
- (9) Protect the component against corrosion after each operation, and place in a container for protection against damage during transit between operations.



- B. Repair Limitations.
 - (1) Chipping of the carbon seal face must not reduce the contact width by more than 20% at any point after lapping (Ref. Fig. 401).
 - (2) The Sealol seal and the mating ring are to be kept together as a matched set.

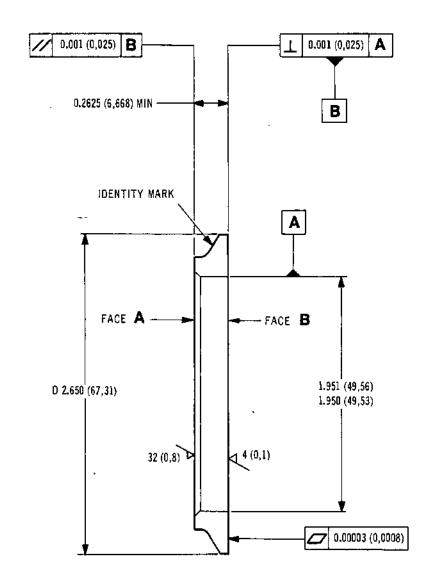
3. Instructions

- A. Sealol Seal Assembly (Scheme B.510619).
 - (1) Clean the Sealol seal assembly using Genklene or white spirit. Immersion may be necessary to ensure adequate cleaning.
 - (2) Inspect the seal for wear and damage to the seal body and the carbon seal face.
 - (3) Remove any raised damage on the seal body by light stoning (Ref.72-09-22 Repair). No reduction in the outside diameter is permitted.
 - (4) Machine lap the carbon seal face to remove wear and damage using aluminium oxide abrasive powder (20 microinch (0,508 micro-metres)) suspended in Abra-lap 2E oil in the ratio of 4 oz. per gallon (25 g/l).
 - (5) Clean thoroughly with Genklene or white spirit to remove lapping paste.
 - (6) Inspect the seal face to ensure that the lapped finish appears across the entire face. No scratches or grooves are allowed, but chipping of the edges is permissible provided that the seal face width is not reduced by more than 20% at any point.
 - (7) Hand lap and polish on a ceramic plate to obtain a seal face flatness of three helium light-bands (max.). Refer to 72-09-00 Inspection/Check.
 - (8) Clean the seal using Genklene or white spirit.
 - (9) Inspect to ensure that the required flatness has been achieved. No scratches, grooves or cracks are permissible.

BELLOWS -2.941 (74,70) 2.939 (74,65) MARK STANDOUT HERE -0.490 (12,45) -0.590 (14,99) NOT MORE THAN 20% 0.530 (13,46) WORKING LENGTH -REDUCTION OF SEAL FACE WIDTH AT ANY POINT DUE TO CHIPPING DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) 0.00003 (0,0008) VIEW AT A 0.090 (2,29) MIN STANDOUT

Sealol Seal Rework Figure 401

Repair No.1 72-63-05 Page 403 Dec 1/88



SECTION THROUGH MATING RING

DIMENSIONS GIVEN ARE SHOWN THUS :- INCHES (MILLIMETRES) SURFACE ROUGHNESS VALUES ARE SHOWN THUS :- MICRO-INCHES (MICROMETRES) \checkmark

Seal Mating Ring Rework Figure 402

Repair No.1 72-63-05 Page 404 Dec 1/88



- (10) Check the seal assembly dimensions (Ref.Fig.401).
 Measure the carbon seal stand-out and record.
- (11) Compression test the bellows unit as indicated in Chapter 72-63-00 Inspection/Check.
- (12) Place the seal in a rigid container for protection.
- B. Seal Mating Ring (Scheme B.510620).
 - (1) Clean the ring using Genklene or white spirit.
 - (2) Inspect faces A and B (Ref.Fig.402) for wear and damage:
 - (3) Remove any raised damage on face A by light stoning (Ref.72-09-22 Repair), and machine lap to obtain a completely flat surface.
 - (4) Clean the ring using Genklene or white spirit.
 - (5) Measure the depth of any scores or scratches on face B. If the depth is greater than 0.001 in. (0,03 mm), grind the face to remove the damage.
 - (6) Machine Lap face B using Hyprez Liquid grade MM142 (heavy removal) and grade M133 (light removal) with type 990/140 Lubricating fluid.
 - (7) Clean the ring using Genklene or white spirit.
 - (8) Inspect the ring to ensure that it is within the limits of finish, flatness and parallelism, and that both faces are completely lapped (Ref. Fig. 402).
 - (9) Hand lap and polish face B on a ceramic plate to obtain a flatness of three helium light bands (max) and a finish better than four micro-inches (0,1 micro-metres). Refer to 72-09-00 Inspection/ Check.
 - (10) Clean the ring using Genklene or white spirit.
 - (11) Check the dimensions of the ring (Ref. Fig. 402).
 - (12) Place the ring in a rigid container for protection.



- C. Vacuum Test (Ref. Fig. 403).
 - (1) Vacuum test the Sealol seal and the mating ring as instructed in Chapter 72-09-00 Inspection/Check.
- D. Identify.
 - (1) Mark the following numbers, using electro-chemical or vibro-percussion marking (Ref.72-09-00 Repair), adjacent to existing markings:
 - (a) Mark B.510619 on the Sealol seal.
 - (b) Mark new value for carbon stand-out and line through existing value.
 - (c) Mark B.510620 on the seal mating ring.
 - (2) Identify the Sealol seal and mating ring as a matched pair using temporary marking (Ref. 72-09-00 Assembly).
- E. Protect.
 - (1) Protect the Sealol seal and mating ring by placing in a rigid container.
- 4. Special Tools, Fixtures and Equipment

None.

Replacement Parts

None.



PULSE PROBE DRIVE AND HOUSING - REPAIR

TABLE OF CONTENTS

Repair No.

Title

Scheme No.

1

Case, Assy of, Sump. Provision for Restoration of Circumferential Band Around Pulse Probe Locating

SAL.B.513546

72-64-00 contents 1 Dec 1/91



CASE, ASSY OF, SUMP

PROVISION FOR RESTORATION OF CIRCUMFERENTIAL BAND AROUND PULSE PROBE LOCATING FACE

REPAIR NO. B513546

1. EFFECTI<u>VITY</u>

IPC

Fig./Item

Part No.

72-64-00

01 090A

B484308

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Locate component on a suitable machine and set true to Datum H. Machine the pre-spray groove to the dimensions shown.

Refer fig.401, 402 and 403

Dimensionally inspect.

Refer fig. 401, 402 and 403

3) Crack Detect repaired area.

Refer Overhaul Manual Chapter 72-64-00 Inspection/Repair

> 72-64-00 Repair No. 1 Page 401 Dec 1/91



4) Mask off area not to be coated and Plasma spray band around Pulse Probe locating face ensuring sufficient thickness so that the final machined diameter is achievable.

Refer fig.404 Refer TSD 594 OP 704 Using MSRR 9507/1 Metco 73F-NS-1).

5) Inspect coating integrity.

Refer TSD 594 OP 704

6) Locate component on a suitable Refer fig.402 and 405 machine and set true. Machine to post spray dimensions shown.

7) Dimensionally inspect.

Refer fig. 401, 402 and 405

Visually inspect coating for 8) defects.

Refer TSD 594 OP 704, Section 8

Vapour Degrease and allow to cool.

Refer Overhaul Manual Chapter 72-09-00, Para 5 Disassembly/Cleaning

10) Oven Dry at 150°C ± 5° for 10-15 minutes.

11) Apply Polyamide clear coating to face X and wipe flush. Stove at 190°C <u>+</u> 5° for 2 hours.

Refer TSD 594 OP 356 using OMAT 7/134. Refer fig. 405

10) Mark SAL.B513546 or R1 and coating symbol WC adjacent to existing part number using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

CASE, ASSY OF . SUMP

H.R.S.

BSEM 515

6. DATA

NONE.

REPAIR Page 402 Dec 1/91



7. <u>TOOLS</u>

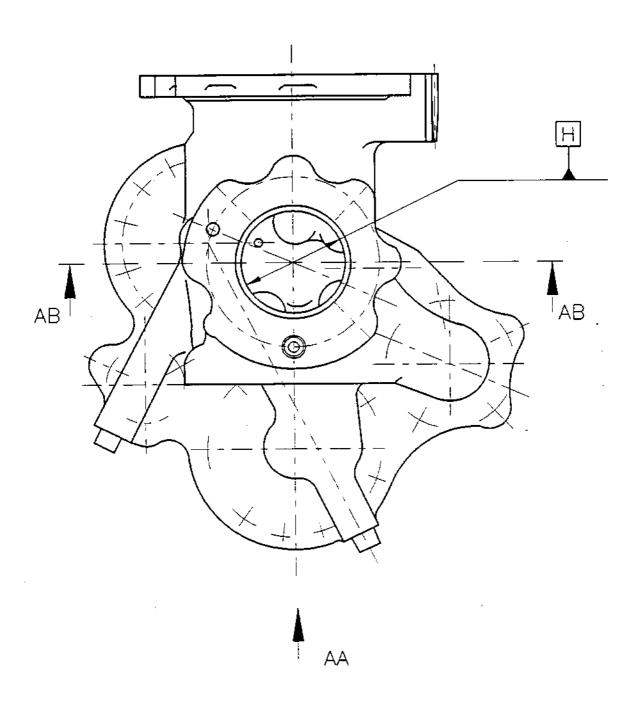
NONE -

8. REPLACEMENT PARTS

NONE.

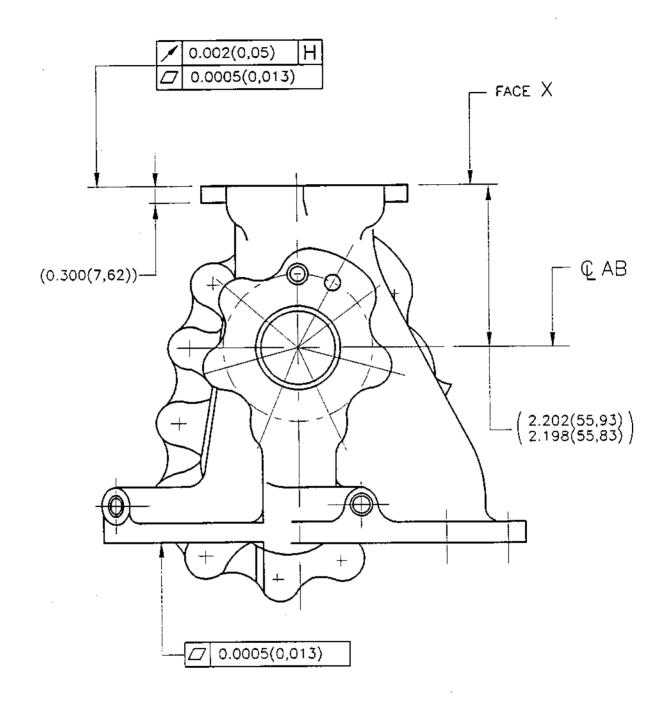
72-64-00 Repair No. 1 Page 403 Dec 1/91

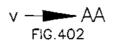




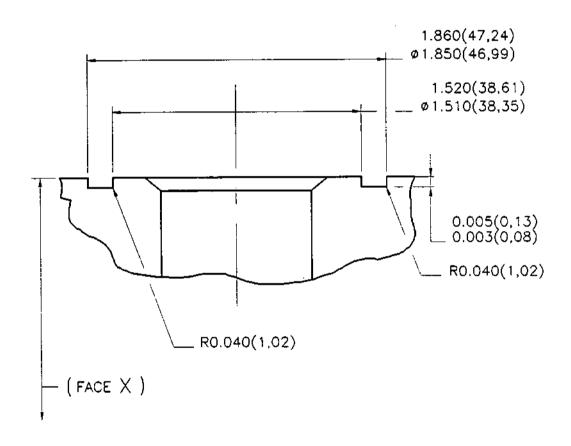
GENERAL VIEW OF PULSE PROBE HOUSING FIG.401

72-64-00 Repair No. 1 Page 404 Dec 1/91









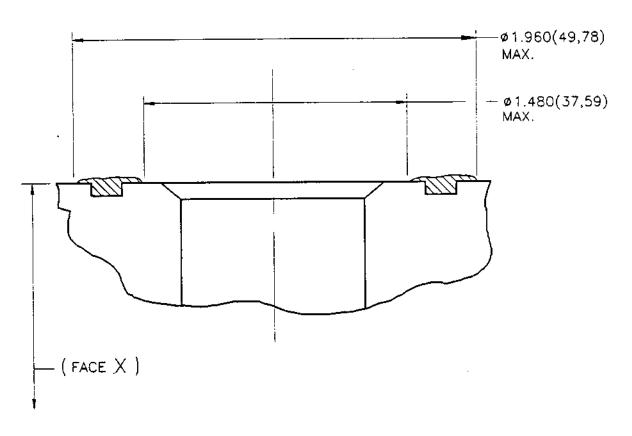
SECTION AB

VIEW SHOWING PRE-SPRAY MACHINING FIG.403

REPAIR 72-64-00 Repair No. 1 Page 406 Dec 1/91



OVERSPRAY NOT PERMITTED OUTSIDE DIMENSIONS SHOWN.

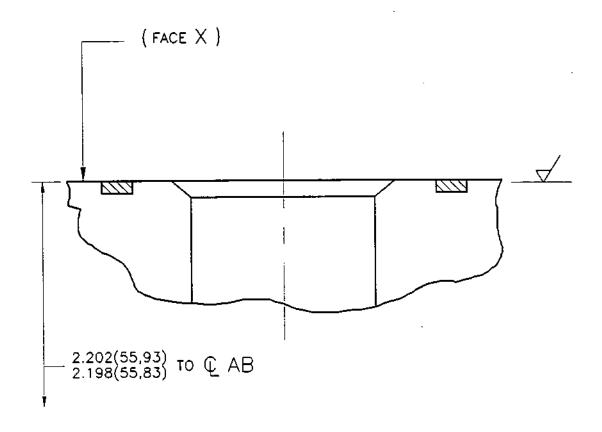


REPEAT SECTION AB

VIEW SHOWING PLASMA SPRAY BUILD UP FIG.404

72-64-00 Repair No. 1 Page 407 Dec 1/91





REPAET SECTION AB

VIEW SHOWING POST SPRAY MACHINING FIG.405

72-64-00 Repair No. 1 Page 408 Dec 1/91



MAIN OIL PUMP - REPAIR

TABLE OF CONTENTS

| | Re | pair No. | Title | Scheme No. |
|--------------------|----|----------|---|-----------------|
| | 1 | 1 | Not Issued | |
| ש | | 2 | Case, Assembly of. Pressure Pump Corrosion/Erosion upto 0.100 (2,54) Depth in Relief Slot | SAL.B.513631 |
| Printed in England | | 3 | Case A/O Pressure Pump Provision for Fitting New Insert, Rings | SAL.B.513619 |
| Printe | | 4 | Main Oil Pump and Pin. Restoration of oil pump gear journals and pin using LWIN4O coating | SAL.B.512304 |
| | | 5 | Case Assy. of, Pressure Pump. Restoration of corrosion/erosion by welding and fitting bushing sleeve(s) | SAL.8:515392-3 |
| | | 6 | Case Assy. of, Pressure Pump and Scavenge Pump. Replacement of damaged/loose bushes fitting 0.005 (0,73) and/or 0.010 (0,25) oversize external diameter bushes. | SAL.B.514883-93 |



CASE, ASSEMBLY OF, PRESSURE PUMP

REPAIR EROSION UP TO 0.100 (2.54) DEEP IN THE RELIEF SLOT BY WELDING AND RE-MACHINING TO MOD 8994 STANDARD.

B513631

1. EFFECTIVITY

| <u>IPC</u> | <u>Fig.</u> | ./Item | Part No. |
|------------|-------------|--------|-------------------------------|
| 72-65-00 | 5 | /160B | 8485980 8485981 8485982 |
| | 5 | /160c | B485983 B485984 |
| | 5 | /160D | B515622 |
| | | | B515623 |
| | | | B515624 |
| | | | B515625 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

Erosion depth must not exceed 0.100 (2,54) refer Fig.3.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO 1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO 1302 (JES137)
Surface texture to be 63 Microinches (1,6 Micrometres)
Welding symbols to ISO 2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- Using conventional hand tools, dress defective area to remove damage.
- Refer Fig.403. Remove minimum material.
- 2) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.213

REPAIR

72-05-00Repair No. 2

Page 401

Jun 1/99

| 3) | Prepare | area | fòr | welding. |
|----|---------------|------|-----|----------|
| | 1 1 4 4 4 4 4 | 4 | 101 | WC COING |

Refer TSD 594 OP.409.

4) Inert gas arc weld.
Apply sufficient weld so as to clean up on final machining.

Refer TSD 594 OP.409 Use filler wire OMat 335.

5) Locally dye penetrant inspect repair area.

Refer TSD 594 0P.213

- 6) Heat treat at 215° C \pm 5° C for 16 hours then cool in air.
- 7) Locate component to machine and set true to existing slot and adjacent outer face.

Refer Figs. 401, 402 and 403.

8) Produce slot to dimensions shown. Machine weld metal flush with existing outer surface ensuring parent material is not impaired, a maximum 0.005(0,13) step around the repair area is permissible.

Refer Figs. 401, 402 and 403.

- NOTE:- THE MACHINING DIMENSIONS OF PARA.4 OP.8 HAVE EMBODIED THE REQUIREMENTS OF MOD 8994.

 THEREFORE, FOR PRE-MOD 8994 COMPONENTS RE-PART NUMBER IN ACCORDANCE WITH THE REQUIREMENTS OF SB-72-8994-393.
- 9) Locally dye penetrant inspect repair area.

Refer TSD 594 OP.213

10) Dimensionally inspect.

Refer Figs. 402 and 403.

11) Locally restore chromate conversion coating to slot only. Refer TSD 594 OP.330 Refer Fig.403.

12) Mark Repair Instruction number RI B513631 or R2 on component, adjacent to normal 'assembly of' number, using the vibropercussion engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

CASE, ASSEMBLY OF, PRESSURE PUMP.

ALUMINIUM ALLOY MSRR8009

LAE

72-65-00Repair No. 2

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REPAIR

6. <u>DATA</u>

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION

ITEM

NONE.

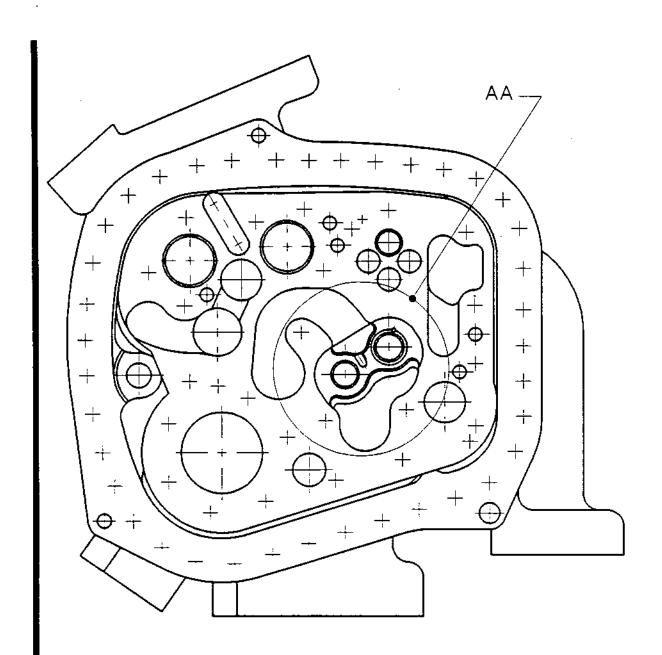
8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

NONE.

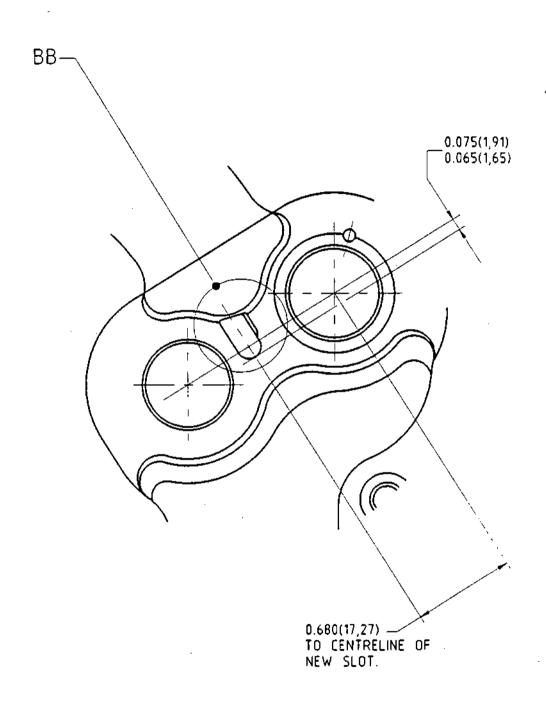
Printed in England





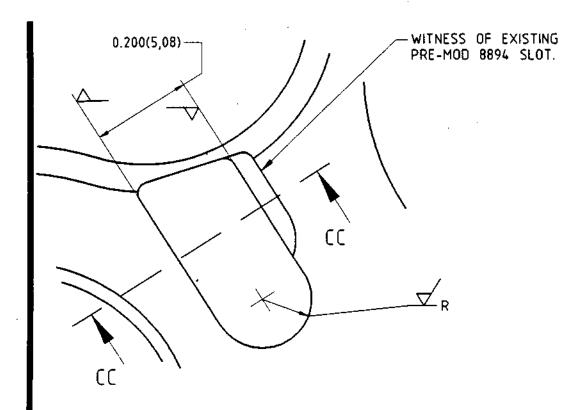
CASING, A/O PRESSURE PUMP FIG.401.

REPAIR 7**2-65-00** Repair No. 2 Page 404 Jan 31/95



VIEW AT AA FIG.402.

REPAIR 72-65-00 Repair No. 2 Page 405 Jan 31/95



VIEW AT BB

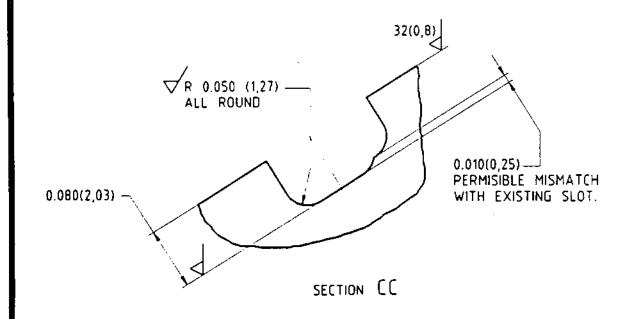


FIG.403.

REPAIR 72-65-00 Repair No. 2 Page 406 Jan 31/95



CASE A/O PRESSURE PUMP

PROVISION FOR FITTING NEW INSERT, RINGS

REPAIR NO. 8513619

1. EFFECTIVITY

IPC

Fig./Item

Part No.

72-65-00

01 001A

B487684

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary reference should be made to the Repair authority for agreement.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimeters)
Tolerances on machined dimensions plus/minus .010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges .004 to .020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometers)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

 Carefully drill out the remains of insert retaining pins at the scavenge filter locations. Refer fig.401 and 402

2) Withdraw all inserts ensuring insert marked BA is removed last. Refer fig.401

Remove any burrs or any protrusions remaining from pins.

> 72-65-00 Repair No. 3 Page 401 Dec 1/91



- 4) Remove any residual traces of Loctite from threads.
- 5) Crack detect repair area.

Refer Overhaul Manual Chapter 72-65-00 Inspection/Check

6) Obtain new insert ring and smear external threads with loctite 270. Assemble insert to location 'BA'. Torque tighten to 200-220 lb.ft. Refer Para 8. REPLACEMENT PARTS Item 1. Refer fig.401

7) Drill 3 equi-spaced holes as shown, 10° clockwise from original hole positions, and fit 3 off retaining pins. Peen to lock each pin in 2 opposing positions. Refer Para 8. REPLACEMENT PARTS Item 3. Refer fig.401 and 402

8) Mount component on a suitable machine and set true. Machine 2 off flats as shown. Refer fig.402 NB: Ensure that pump casing is not damaged.

9) Dimensionally inspect.

Refer fig.402

10) Crack detect repair area.

Refer Overhaul Manual Chapter 72-65-00 Inspection/Check

11) Obtain 2 new insert rings and smear external threads with Locktite 270. Assemble inserts to location 'BB' and 'BC'. Torque tighten to 200-220 lb.ft.

Refer Para 8. REPLACEMENT PARTS Item 1. Refer fig.401

12) Drill 3 equi-spaced holes as shown 60° from original hole positions and fit 3 off retaining pins.

Peen to lock each pin in 2 opposing positions.

Refer Para 8. REPLACEMENT PARTS Item 3. Refer fig.402 and 402

13) Select new insert ring and smear external threads with loctite 270.
Assemble insert to location 'BD'.
Torque tighten to 300 - 330 lb.ft.

Refer Para 8. REPLACEMENT PARTS Item 2. Refer fig.401

72-65-00 Repair No. 3 Page 402 Dec 1/91



14) Drill 3 equi-spaced holes as shown 40° from original hole positions and fit 3 off retaining pins. Peen to lock each pin in 2 opposing positions. Refer Para 8. REPLACEMENT PARTS Item 3. Refer fig.401 and 402

15) Mount component on a suitable machine and set true. Machine 8 off dogs to dimensions shown. Refer fig.403

16) Dimensionally inspect.

Refer fig.403

17) Crack detect repair area.

Refer Overhaul Manual chapter 72-65-00 Inspection/Check

18) Mark on SAL B513619 or R3 adjacent to existing part part number using vibro-percussion engraving.

Refer Overhaul Manual Chapter 72-09-00 Repair.

5. MATERIAL

COMPONENT.

MATERIAL.

RR CODE.

CASE A/O PRESSURE PUMP

ALUMINIUM ALLOY MSRR 8009 LAE

6. DATA

NONE.

7. <u>TOOLS.</u>

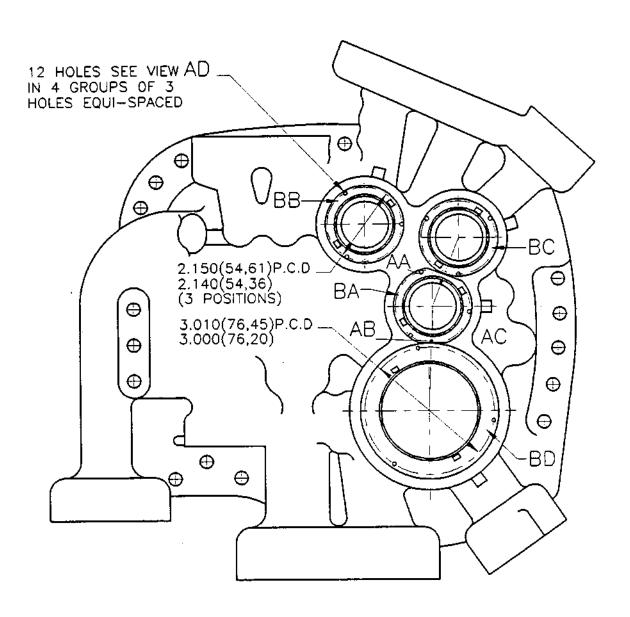
NONE.

8. REPLACEMENT PARTS

| PART NO. | COMPONENT | QUANTITY | ITEM NO. |
|-----------|-----------------------|----------|----------|
| B458582 | INSERT RING | 3 | 1 |
| B458581 | INSERT RING | 1 | 2 |
| FBS379-A3 | PIN STRAIGHT HEADLESS | 12 | 3 |

72-65-00 Repair No. 3 Page 403 Dec 1/91





CASING, A/O PRESSURE PUMP FIG.401

72-65-00 Repair No. 3 Page 404 Dec 1/91



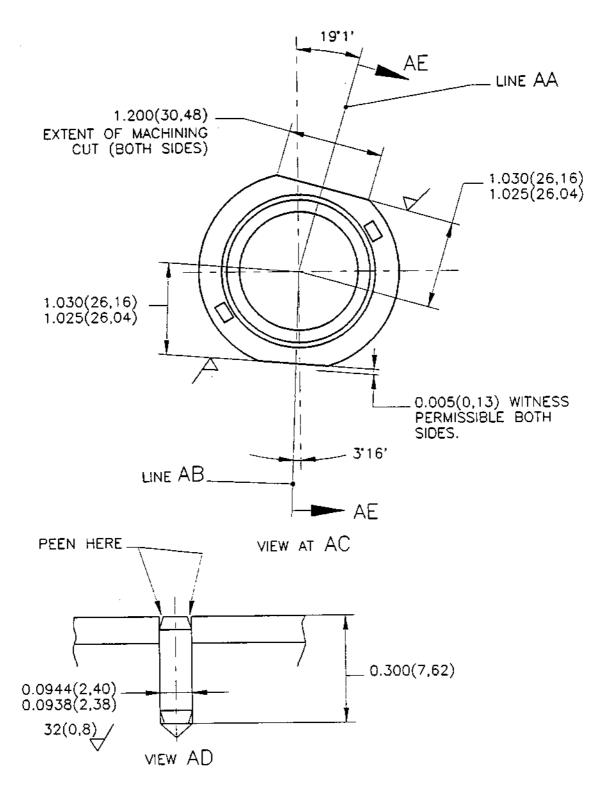
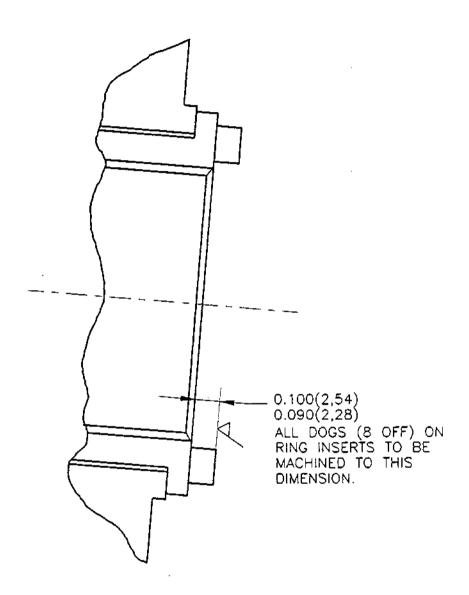


FIG.402





SECTION AE FIG.403

72-65-00 Repair No. 3 Page 406 Dec 1/91



MAIN OIL PUMP GEARS AND PIN

RESTORATION OF OIL PUMP GEAR JOURNALS AND PIN USING LWIN40 COATING

REPAIR NO. B512304

1. EFFECTIVITY

| IPC | <u>Fig</u> | <u>./Item</u> | <u>Part No.</u> |
|----------------|------------|---------------|-----------------|
| 72-65-00 | 3 | 410A | в417389 |
| 72-65-00 | 4 | 300A | B417387 |
| 72-65-00 | 3 | 48DA | B417384 |
| 72-65-00 | 3 | 490A | B417390 |
| 72-65-00 | 4 | 110A | B417391 |
| 72-65-00 | 4 | 100A | B417385 |
| 72-65-00 | 4 | 170A | B417386 |
| 72-65-00 | 4 | 200A | 8470867 |
| 72-65-00 | 4 | 200A | 8470868 |
| 72-65-00 | 4 | 200A | 8471591 |
| 72-65-00 | 5 | 130A | B417393 |
| - - | | | |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This Repair Procedure may be embodied any number of times provided dimensional limitations are not exceeded. Refer fig. 402 to 412.

This Repair Instruction is not applicable to components previously repaired using non-standard coatings.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

REPAIR

72-65-00 Repair No. 4 Page 401 Jan 31/95



4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

1) Visually inspect for previous coating identity symbols which are not included in this Repair Instruction. If a non-standard coating symbol is evident, reject component.

REPEAT REPAIRS ONLY

NOTE: For new Repair aristings, operations 2 to 4 are not required. Proceed to operation 5 (pins) or 7 (gears) as applicable.

Chemically strip existing coating.

Refer Overhaul Manual Chapter 72-09-25, Repair Process F. Ensure un-plated areas are adequately masked.

- 3) Heat treat component at 2000 ± 10° for 1 hour. Cool in air.
- 4) Locally etch to ensure complete removal of coating.

Refer Overhaul Manual
Chapter 72-09-14, Repair
Solution E.
NOTE: Repeat operations 2
to 4 if required. On satisfactory removal, proceed
directly to operation 11.

FIRST REPAIRS ONLY

NOTE: If pin repair is required, operations 5 and 6 are to be carried out first to establish Repair datums A and B. For gears proceed to operation 7.

5) Locate pin on cylindrical grinding machine and clock outside diameters X true. Refer fig. 409.

6) Machine slots Y and Z to clean up. Remove minimum amount of material. Refer fig. 409.

7) Set gear/pin true to Datum(s).

Refer figs.401 to 412 (as applicable).

8) Machine to pre-coating dimensions.

Refer figs.401 to 408 and 410 to 412 (as applicable).

REPAIR 72-65-00 Repair No. 4 Page 402 Jan 31/95



| 9) | Heat | treat | componer | nt at | 1500 |
|----|-------------|--------|----------|-------|---------|
| | <u>+</u> 50 | for 1 | hour in | air | or oil. |
| | Cool | in air | - | | |

- 10) Locally etch and visually Refer TSD 594 Op.138, inspect for grinding abuse. Para.D (Nitric acid).
- 11) Locally crack detect gear/pin. Refer Overhaul Manual Chapter 72-65-00,
- 12) Dimensionally inspect. Refer figs.401 to 408 and 410 to 412 (as applicable).

Inspection/Check

- 13) Vapour degrease. Refer TSD 594 OP.101.
- 14) Detonation flame spray to within Refer figs.401 to 408 and limitations given over distances 410 to 412 (as applicable). Refer TSD 594 OP.704. Use LWIN40 (OMat 3/131).
- 15) Visually inspect integrity of Refer TSD 594 OP.704. coating.
- 16) Set gear/pin true to datum(s). Refer figs.401 to 408 and 410 to 412 (as applicable).
- 17) Diamond grind gear/pin journal Refer TSD 594 OP.704.
 to final dimensions given. Refer figs.401 to 408 and
 410 to 412 (as applicable).
- 18) Visually inspect integrity of Refer TSD 594 OP.704. coating. Ensure there is no plucking or lifting of coating.
- 19) Dye penetrant inspect Repair Refer TSD 594 OP.210. area(s).
- 20) Mark Repair Instruction Number Refer Overhaul Manual RI B512304 or R4 and coating Chapter 72-09-00, Repair. identity symbol adjacent to the normal 'assy of' number using

Coating identity symbol WC

technique.

the vibro-percussion engraving

21) Temporarily protect gear/pin. Refer TSD 594 OP.340.

72-65-00 Repair No. 4 Page 403 Jan 31/95



5. MATERIAL

<u>COMPONENT</u> <u>MATERIAL</u> <u>RR CODE</u>

MAIN OIL PUMP GEARS \$106 --

AND PIN.

6. DATA

None.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

None.

8. REPLACEMENT PARTS

PART NUMBER DESCRIPTION QUANTITY ITEM

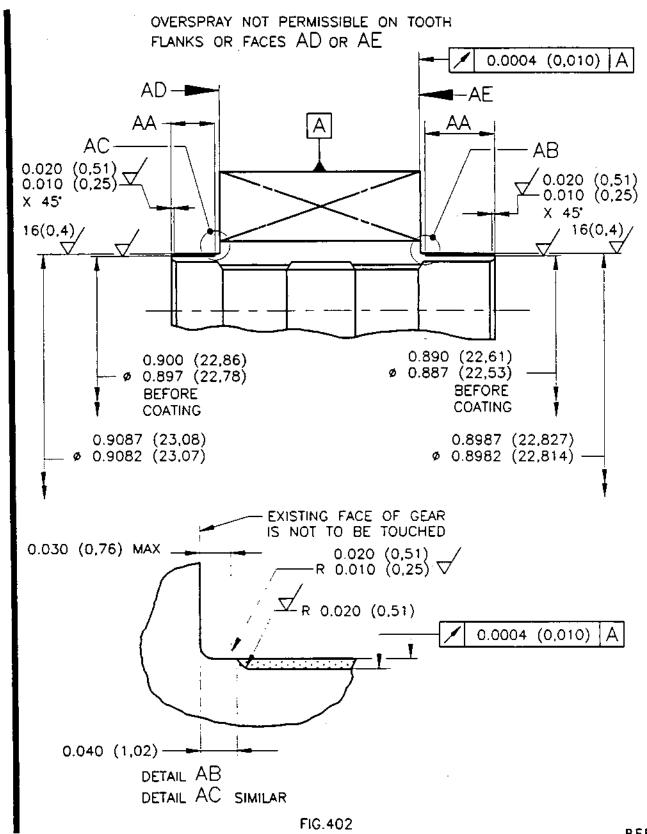
None.

| PART NO. | FIG.NO. | DESCRIPTION |
|----------|---------|--------------------|
| B417384 | 404 | GEAR SCAVENGE PUMP |
| B417385 | 407 | GEAR SCAVENGE PUMP |
| B417386 | 408 | GEAR SCAVENGE PUMP |
| B417387 | 403 | GEAR PRESSURE PUMP |
| B417389 | 402 | GEAR SCAVENGE PUMP |
| 8417390 | 405 | GEAR SCAVENGE PUMP |
| B417391 | 406 | GEAR SCAVENGE PUMP |
| B417393 | 412 | GEAR SCAVENGE PUMP |
| B470867 | 409-411 | PIN |
| B470868 | 409-411 | PIN |
| B471591 | 409-411 | PIN |

GEAR/PIN FIGURE REFERENCE TABLE FIG.401

REPAIR 72-65-00 Repair No. 4 Page 405 Jan 31/95

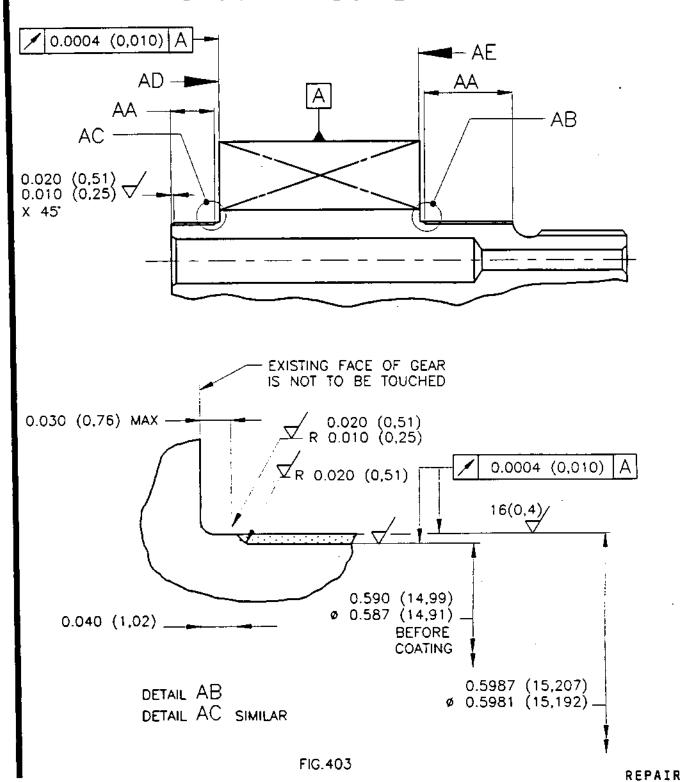




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Printed in England



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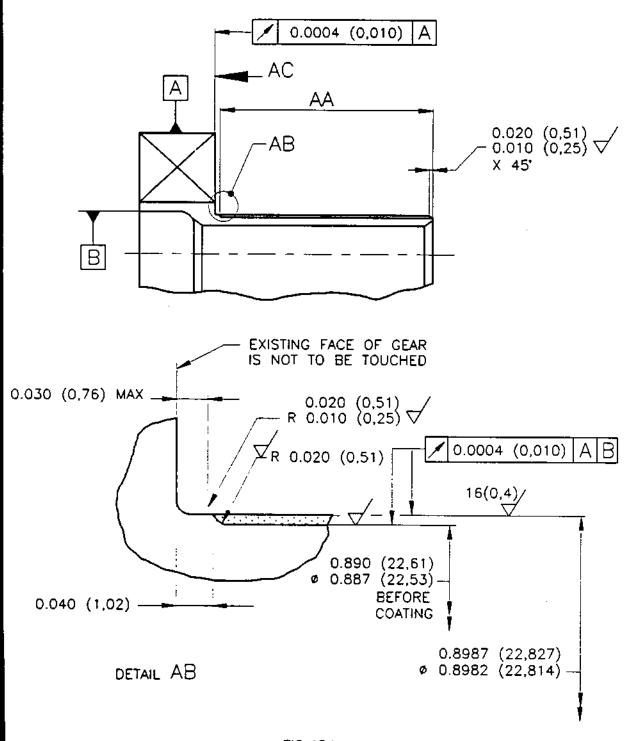
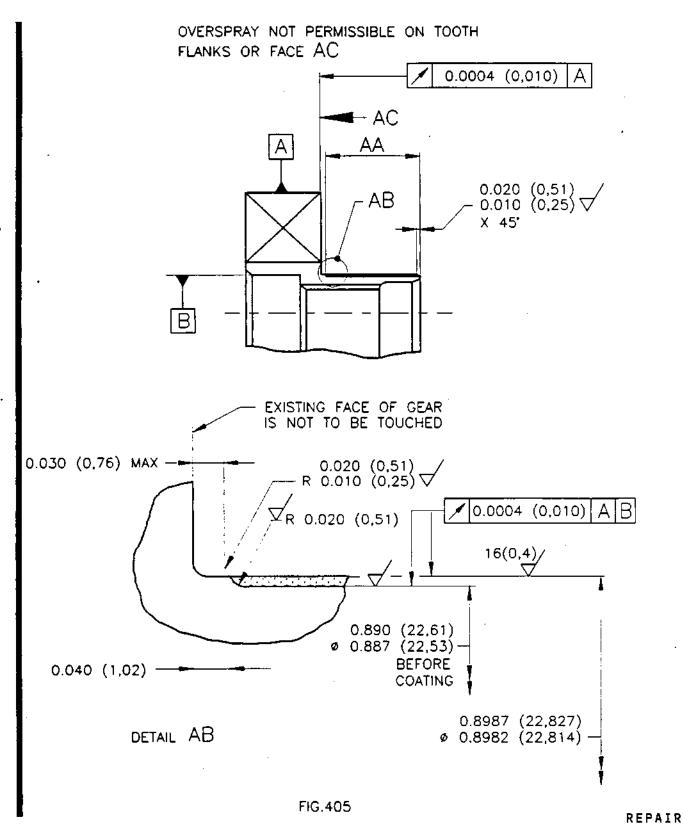


FIG.404

REPAIR **72-65-00** Repair No. 4 Page 408 Jan 31/95

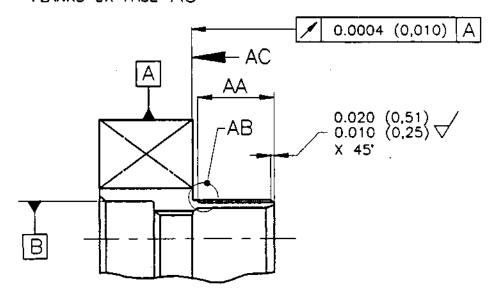


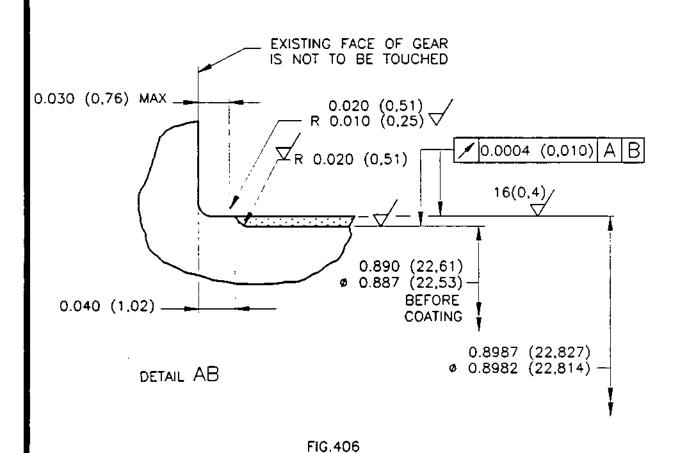
Printed in England



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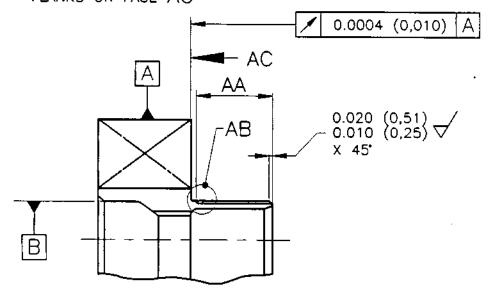


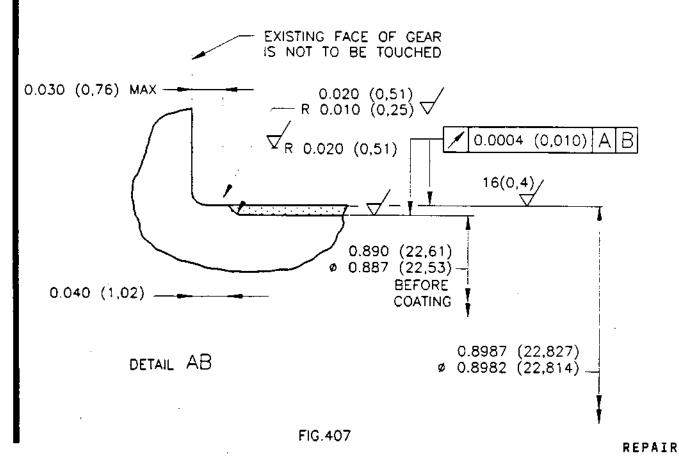


REPAIR 72-65-00

Repair No. 4 Page 410 Jan 31/95





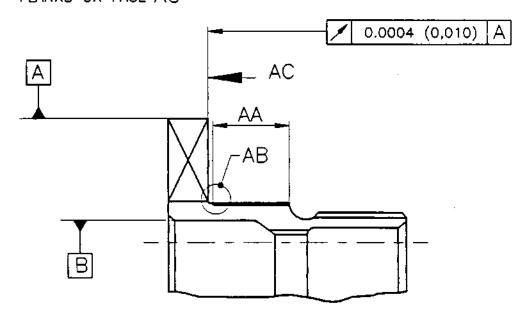


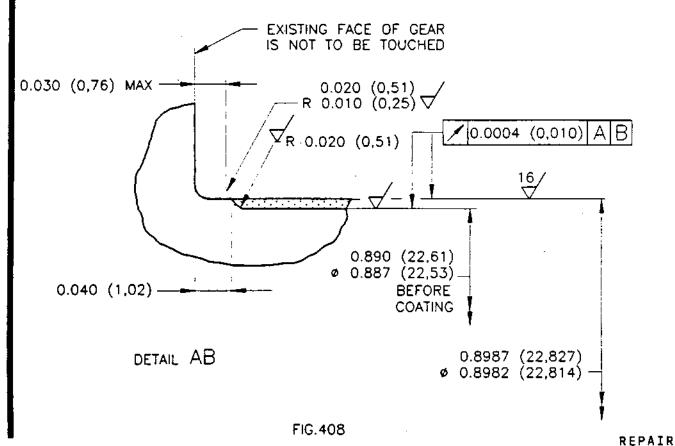
72-65-00Repair No. 4

Page 411

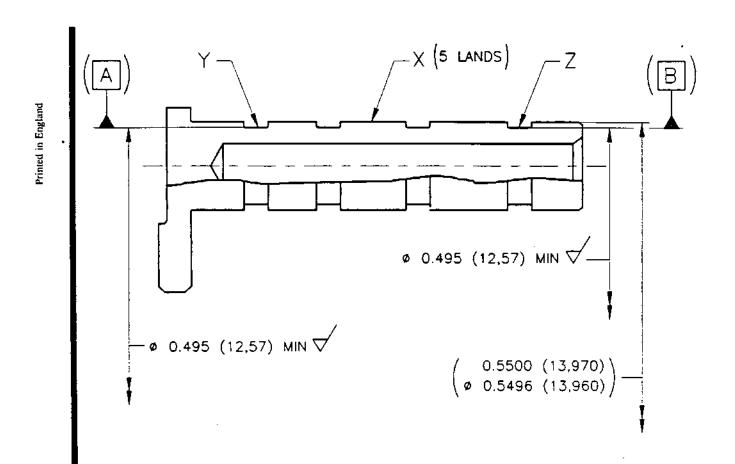
Jan 31/95







72-65-00 Repair No. 4 Page 412 Jan 31/95



VIEW SHOWING MACHINING OF SLOTS TO CREATE DATUMS A AND B

FIG.409

REPAIR 7**2-65-00** Repair No. 4 Page 413 Jan 31/95



OVERSPRAY IS PERMISSIBLE IN GROOVES AF (FIG.411), BUT NOT IN HOLES OR ON FACE AG.

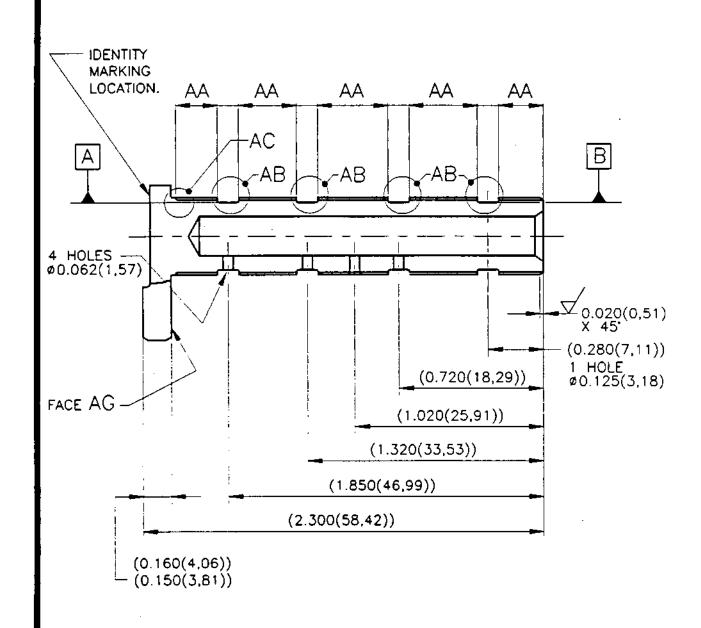
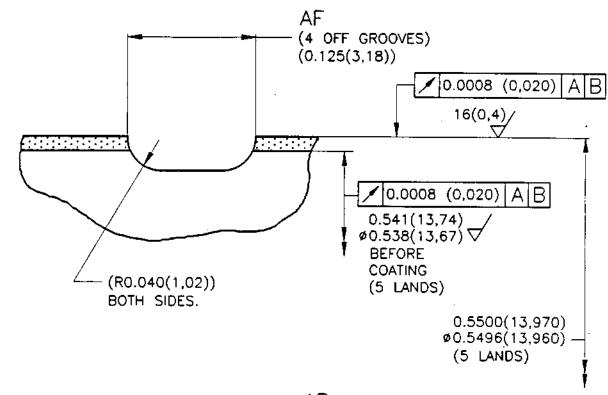
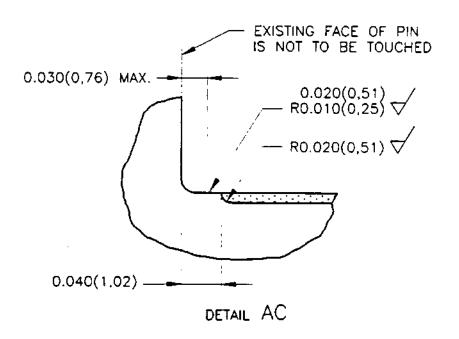


FIG.410

REPAIR 72-65-00 Repair No. 4 Page 414 Jan 31/95







PIN FINISHING DETAIL-REFER FIG.410 FIG.411

REPAIR 72-65-00 Repair No. 4 Page 415 Jan 31/95



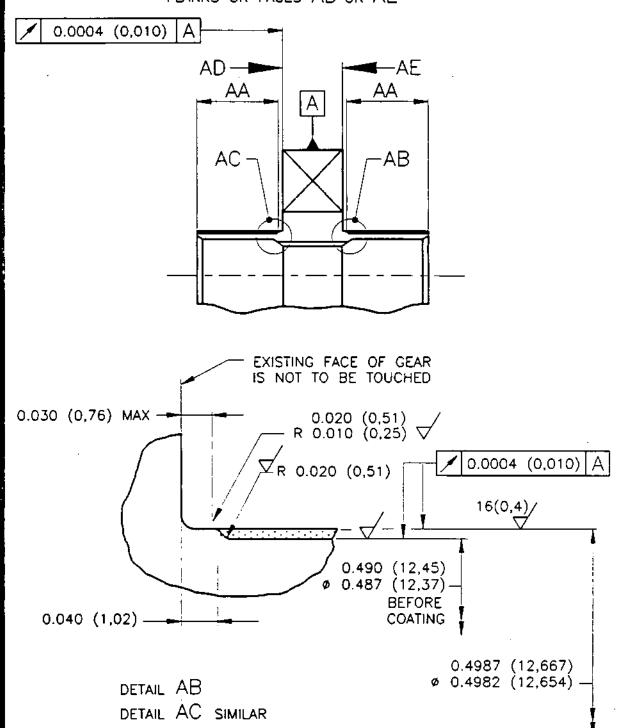


FIG.412

REPAIR 72-65-00 Repair No. 4 Page 416 Jan 31/95



CASE ASSY OF, PRESSURE PUMP

RESTORATION OF DAMAGED BORE LOCATIONS

REPAIR NO. B515392-3

1. EFFECTIVITY

| <u>IPC</u> | Fig./Item | Part No. |
|------------|-----------|--|
| 72-65-00 | 5 160B | B485980 B485981 B485982 B485983 |
| | 160D | B515622 B515623 B515624 B515625 |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

8515392 - RESTORATION OF DAMAGED BORE - LOCATION A. Ref fig. 401.

B515393 - RESTORATION OF DAMAGED BORE - LOCATION B. Ref fig.401.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)
Surface texture to be 125 (3,2) Microinches (Micrometres)
Welding symbols to ISO2553 (JES139)
3rd Angle Projection

4. REPAIR PROCEDURE

SUPPLEMENTARY INFORMATION

- 1) Set component true to datums X,Y,& Z on a milling machine.
- Refer figs.401 and 403.
- 2) Drill and remove bush retaining screw(s) (if applicable).

Refer figs.404, 405, 408 and 409.

REPAIR

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3) Machine Bush Location(s) to remove existing Bush(s) as required. Refer figs 402.and 406.

4) Remove burrs/high metal.

5) Check the oil passages between the bearing locations for obstructions. If necessary, open out the oil passages by drilling. Refer fig. 402.

6) Set component true to datums X,Y,& Z.

Refer figs.401, and 403.

7) Dimensionally inspect size and position of Bore - Location A. If ovality/damage is present, machine the bore removing the minimum amount of material necessary to install bush of minimum outside diameter 0.750(19,05).

Refer figs.401 and 402.

8) Dimensionally inspect size and position of Bore - Location B. If ovality/damage is present, machine the bore removing the minimum amount of material.

NOTE: If oversize bush is required carry out repair to RI B514893K or R.6K.

Refer figs.401 and 406.

- 9) Remove burrs/high metal.
- 10) Dimensionally inspect repaired area(s).

Refer figs.402 and 406.

Crack Detect repaired area(s).

Refer TSD 594 OP.213.

12) Locally reprotect machined area(s).

Refer TSD 594 OP.330.

13) Select appropriate repair bush(s)/standard bush as required.

Refer para.8. REPLACEMENT PARTS items 2 or 3. Refer fig.405.

NOTE: Where an oversize bush has been selected for location A, machine bush outside diameter to suit prepared location.

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| 14) | If an oversize bush has been selected, locally re-protect bush machined areas. | Re |
|-----|--|----|
| 455 | Hart 45 19000 + | |

Refer TSD 594 OP.330.

- 15) Heat casing to 180°C <u>+</u> 5°C.
- 16) Assemble repair bush(s)/
 standard bush into
 location bore(s) of
 casing as required.
 Do not insert bush(s)
 underflush.
 NOTE: Ensure flat on
 bush is in correct
 alignment with oil
 feed hole in pump
 casing.

Refer figs.403 and 407.

17) Visually Inspect to ensure repair bush(s)/ standard bush is not underflush. Refer figs.403 and 407.

18) Fill any existing replacement locking plug hole(s) using aluminium filled epoxy resin. Refer TSD 594 OP 707 using OMat 836. Refer figs.404 and 408.

19) Set housing true to Datum Face 'Z'.

Refer figs. 403 and 407.

2D) Produce threaded hole(s) for replacement locking plug(s) as required.

Refer figs.404, 405, 408 and 409.

- 21) Remove burrs/high metal.
- 22) Dimensionally inspect
 threaded hole(s).

Refer figs.404, 405, 408 and 409.

23) Locally reprotect
 machined area(s)

Refer TSD 594 OP.330.



| 24) | Fit replacement |
|-----|----------------------|
| | locking plug(s), |
| | using thread locking |
| | adhesive. |
| | Do not overtighten. |

Refer para 8. REPLACEMENT PARTS item 1. Use Locking Glue OMat 8/69. Refer Figs.404, 405, 408 and 409.

- 25) Remove head of locking plug(s) using conventional hand tools (or by machining).
- 26) Finish machine bush.
 Bush (and locking plug)
 to be produced flush with
 casing faces (where
 applicable). Do not
 impair casing surfaces.

Refer figs.401, 403, 405, 407 and 409.

27) Extend oil passageway through bush and into bore.

Refer fig. 403.

28) Check oil passageway for obstruction.

Refer fig. 403.

29) Dimensionally Inspect.

Refer figs.401, 403, 404, 405, 407, 408 and 409.

30) Crack Detect.

Refer TSD 594 OP.213.

31) Mark appropriate Repair
Instruction or Repair identity
number on component adjacent
to normal 'assembly of' number
using the vibro-percussion
engraving technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer TABLE 1. Refer fig.407.

| REPAIR INSTRUCTION NUMBER. | LOCATION (REFER FIG 404) | REPAIR INSTRUCTION IDENTITY MARKING REQUIRED | REPAIR IDENTITY NUMBER |
|----------------------------------|--------------------------------|--|------------------------------|
| B515392 | Α | RI B515392 | R.5A |
| в515393 | В | RI B515393 | R.58 |

TABLE 1

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| 5. | , | M | A | Т | Ε | R | 1 | <u>A</u> | L |
|----|---|---|---|---|---|---|---|----------|---|
| | | | | | | | | | |

| COMPONENT | <u>MATERIAL</u> | RR CODE |
|-----------------------------------|---------------------------------|---------|
| CASE, ASSEMBLY OF, PRESSURE PUMP. | ALUMINIUM ALLOY MSRR 8009 | LAE |

6. DATA

NONE.

7. <u>TOOLS</u>

TOOL NUMBER DESCRIPTION ITEM

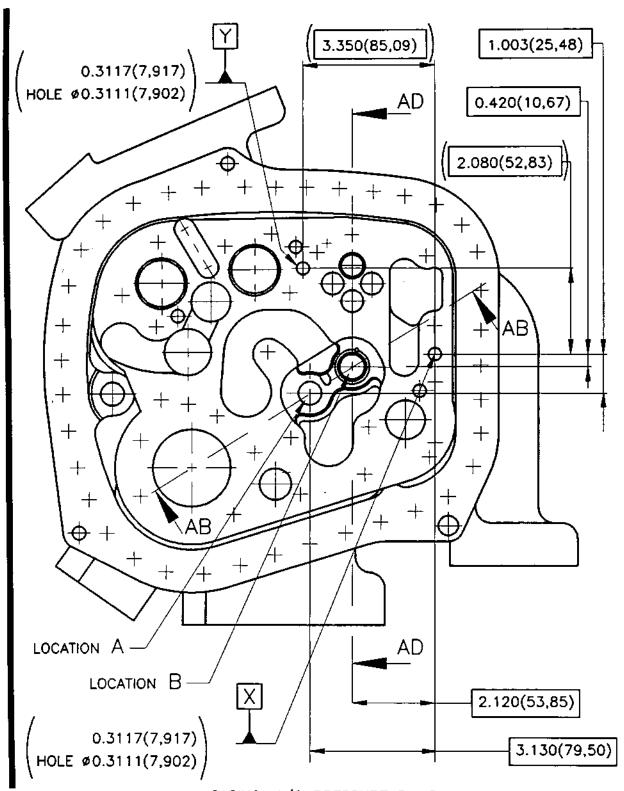
NONE.

8. REPLACEMENT PARTS

| PART NUMBER | <u>DESCRIPTION</u> | QUANTITY | <u>ITEM</u> |
|-------------|--------------------|----------|-------------|
| B100528 | PLUG, SCREWED | 2 | 1 |
| B427150 | BUSHING, SLEEVE | 1 | 2 |
| B515394 | BUSHING, SLEEVE | 1 | 3 |

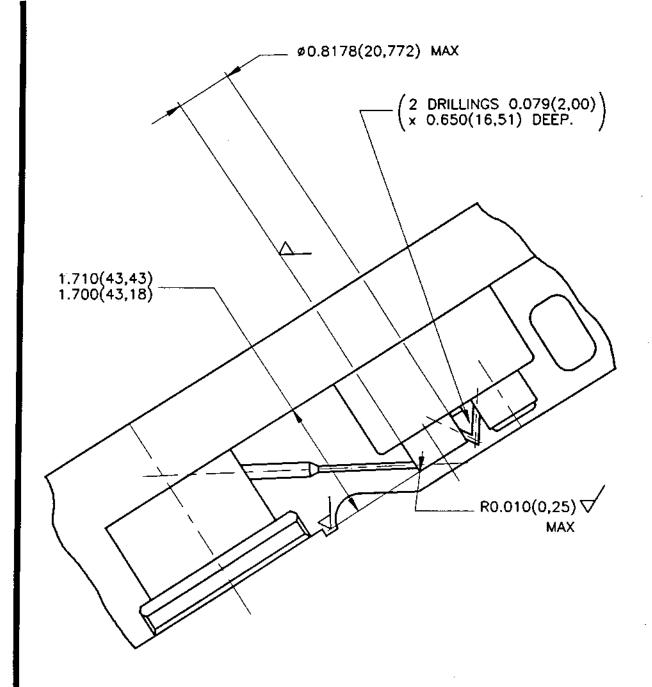
REPAIR 72-65-00 Repair No. 5 Page 405 Jun 1/96





CASING, A/O PRESSURE PUMP FIG.401.

REPAIR 72-65-00 Repair No. 5 Page 406 Jun 1/96



SECTION AB
SHOWING MACHINING DETAILS (LOCATION A)
WITH BUSH (LOCATION B) REMOVED

FIG.402.

REPAIR 72-65-00 Repair No. 5 Page 407 Jun 1/96



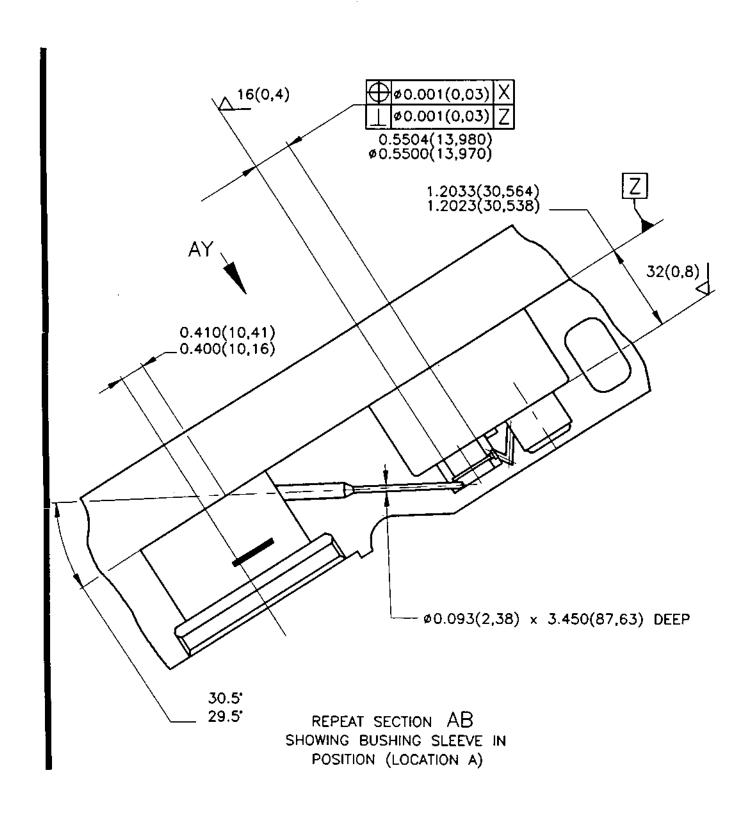
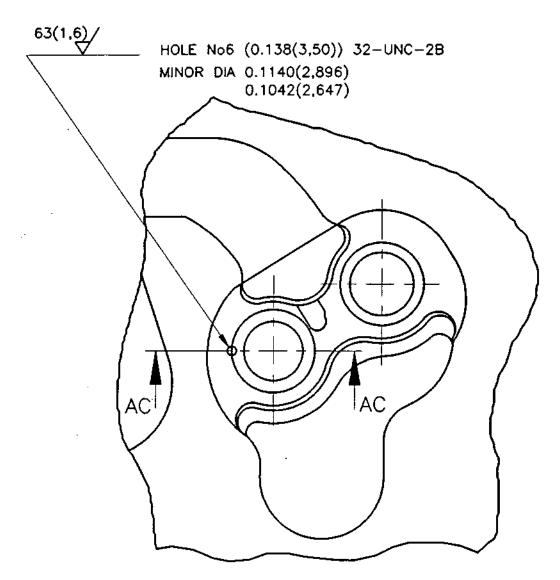


FIG.403.

REPAIR 72-65-00 Repair No. 5 Page 408 Jun 1/96

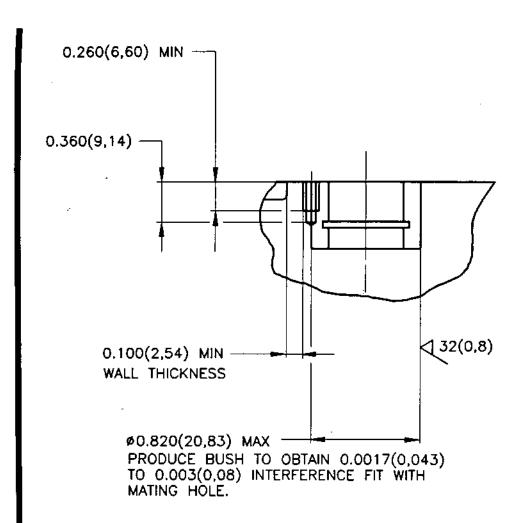


NOTE:— HOLE FOR LOCKING PLUG TO BE POSITIONED
AS SHOWN FOR FIRST REPAIR.
HOLE FOR SUBSEQUENT REPAIRS TO BE
POSITIONED 30°/35° AROUND FROM
EXISTING HOLE.



FIG.404.

REPAIR 72-65-00 Repair No. 5 Page 409 Jun 1/96



SECTION AC

FIG.405.

REPAIR 72-65-00 Repair No. 5 Page 410 Jun 1/96

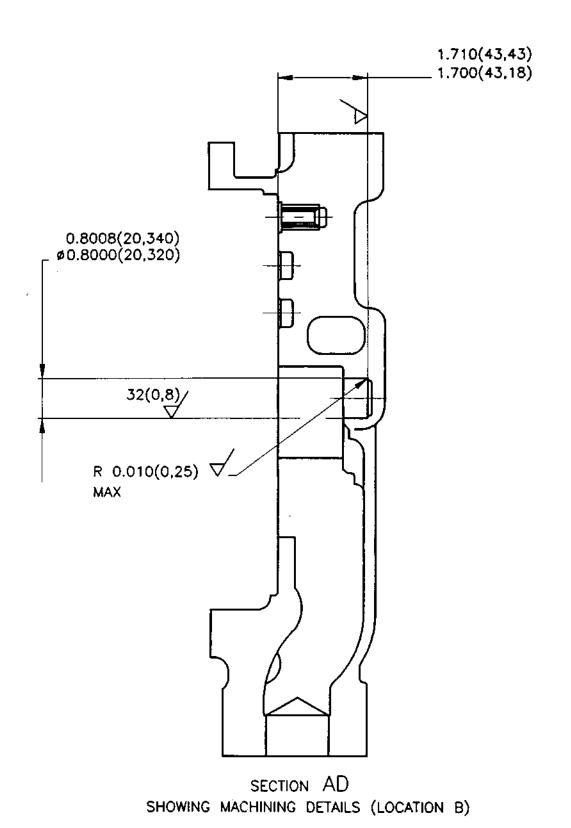
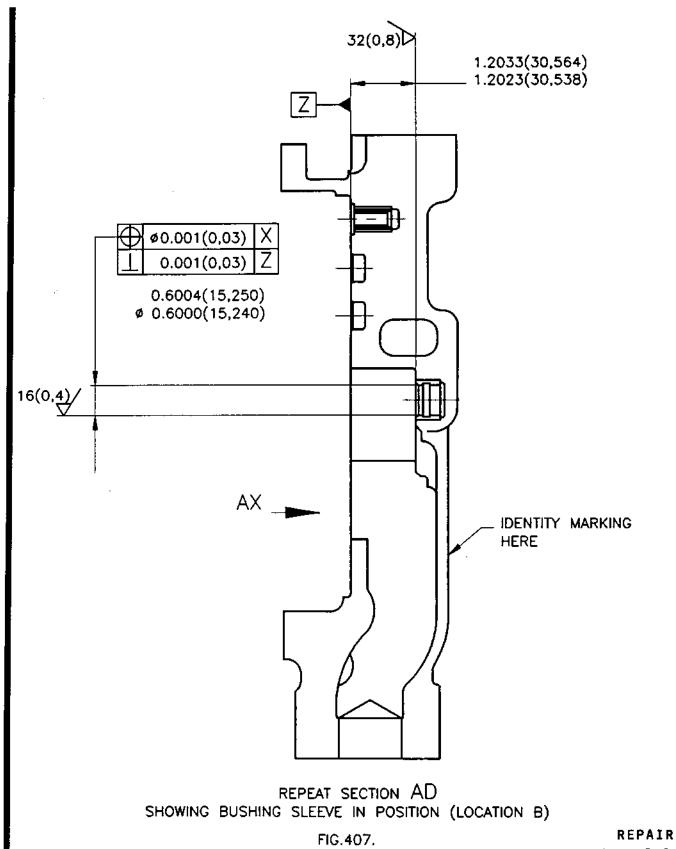


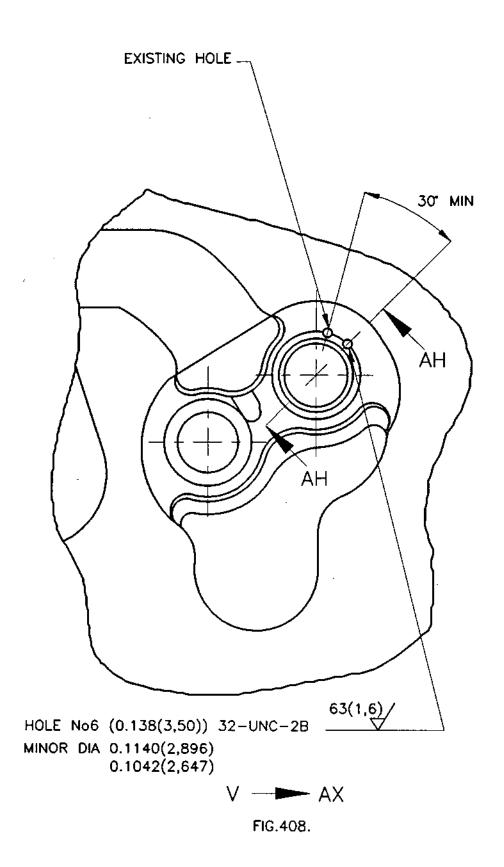
FIG.406.

REPAIR 72-65-00 Repair No. 5 Page 411 Jun 1/96

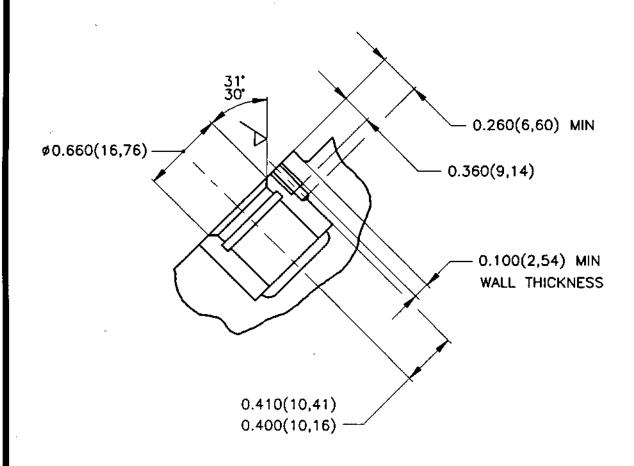




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REPAIR 72-65-00 Repair No. 5 Page 413 Jun 1/96



SECTION AH

FIG.409.

REPAIR
72-65-00
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CASE, ASSEMBLY OF, PRESSURE AND SCAVENGE PUMPS

REPLACEMENT OF DAMAGED/LOOSE BUSHES BY FITTING 0.005(0,13) AND/OR 0.010(0.25) OVERSIZE EXTERNAL DIAMETER BUSHES

REPAIR NO. B514883-93

1. <u>EFFECTIVITY</u>

| <u>IPC</u> | <u>Fig</u> | ./Item | Part No. | |
|------------|------------|--------|----------|---------|
| 72-65-00 | 3 | 290A | в473836 | |
| | | 420A | B477554 | |
| | 4 | 50A | B480941 | |
| | | | B480943 | |
| | | 120A | B480939, | B477416 |
| | | 210A | B480937, | B477414 |
| | | 210B | B489184 | |
| | | | B489186 | |
| | 5 | 160A | В480934 | |
| | | 160B | 9485980 | |
| | | | B485981 | • |
| | | | 8485982 | |
| | | | B485983 | |
| | | 160c | B485984 | |
| | | 160Þ | B515622 | |
| | | | B515625 | |

2. REPAIR LIMITATIONS

Compliance with all aspects of this repair process should be achieved without deviation. Where a need to deviate is considered necessary, reference should be made to the Repair Authority for agreement.

This repair instruction may be embodied up to two times at any or all of the repair locations A-K (refer Table 1) provided that the dimensions stated in Table 1 and the minimum wall sections quoted in figures 405, 410, 415, 420, 425 and 430 are maintained.

3. GENERAL

UNLESS OTHERWISE SPECIFIED
Drawing practice & tolerance interpretation to ISO1101 (JES160)
Dimensions in Inches (Millimetres)
Tolerances on machined dimensions plus/minus 0.010 (0,25)
Tolerance on angles plus/minus 2 degrees
Break sharp edges 0.004 to 0.020 (0,1 to 0,5)
Surface texture interpretation to ISO1302 (JES137)

REPAIR

72-65-00 Repair No. 6 Page 401 Jun 30/01 Surface texture to be 125 (3,2) Microinches (Micrometres) Welding symbols to ISO2553 (JES139) 3rd Angle Projection

| 4. | REPAIR PROCEDURE | SUPPLEMENTARY INFORMATION |
|-----|--|---|
| 1) | Set component true to datums on a jig borer. | Refer fig's 401, 403, 406, 408, 411, 413, 416, 418, 421, 423, 426 and 428 (as applicable). |
| 2) | Drill out existing locking plug(s). | Refer fig's 404, 409, 414, 419, 424 and 429 (as applicable). |
| 3) | Machine bush location(s) to remove existing bush and open up location bore to the required degree of oversize. | Refer fig's 402, 407, 413, 417, 422 and 427 (as applicable). Refer Table 1. |
| 4) | Remove burrs/high metal. | |
| 5) | Dimensionally inspect repair area(s). | Refer fig's 402, 407, 413, 417, 422 and 427 (as applicable). Refer Table 1. |
| 6) | Crack detect repair area(s). | Refer Overhaul Manual Chapter 72-65-00 Inspection/Check. |
| 7) | Locally reprotect machined area(s). | Refer Overhaul Manual Chapter 72-09-02 Repair. |
| 8) | Heat casing to 180° C \pm 5°C. | |
| 9) | Select required repair bush. | Refer para.8. REPLACEMENT PARTS, items 1-18. Refer Table 2 and 4. |
| 10) | Assemble repair bush into location bore of casing using a suitable press. For blind recess locations, ensure bush is bottomed. For through hole locations, bush must be assembled flush to 0.005 (0,13) overflush to the lower | Refer fig's 403, 408, 413, 418, 423 and 428 (as applicable). |

face of casing.

Ensure flat(s) on bush are in correct alignment (at right

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angles) with oil feed hole(s) in pump casing.

11) Pimensionally inspect to ensure that at through hole locations, the bottom face of bush is flush to 0.005(0,13) overflush on bottom face of casing. Refer fig's 403, 408, 413, 418 and 423 (as applicable).

12) Visually inspect to ensure repair bush is not underflush to any casing location face and at blind recess locations, bush has fully bottomed. Refer fig's 403, 408, 413, 418, 423 and 428 (as applicable).

13) Fill any existing locking pin hole(s) using aluminium filled epoxy resin. Refer TSD 594 OP 707. Use OMat 836.

14) Set component true to datums on a jig borer. Refer fig's 401, 403, 406, 408, 411, 413, 416, 418, 421, 423, 426 and 428 (as applicable).

15) Produce threaded hole(s) for replacement locking plug(s). Ensure each repair threaded hole is positioned to maintain the the minimum angle (from existing plug holes) and the minimum wall section limitations.

Refer fig's 404, 405, 409, 410, 414, 415, 419, 420, 424, 425, 429 and 430 (as applicable). Refer para. 2. REPAIR LIMITATIONS.

- Nb. It is essential that the minimum wall section is applied between repair plug holes and existing casing oilways.
- 16) Remove burrs/high metal.
- 17) Dimensionally inspect threaded hole(s).

Refer fig's 404, 405, 409, 410, 414, 415, 419, 420, 424, 425, 429 and 430 (as applicable).

18) Locally reprotect machined area(s).

Refer Overhaul Manual Chapter 72-09-02 Repair.

19) Fit replacement locking plug(s). Do not overtighten. Refer fig's 404, 405, 409, 410, 414, 415, 419, 420,

REPAIR

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424, 425, 429 and 430 (as applicable). Refer para. 8. REPLACEMENT PARTS, items 19 and 20. Refer Table 2.

20) Remove head of locking plug using conventional hand tools (or by machining). Protect casing from accidental damage.

21) Finish machine bush. Bush (and locking plug) to be produced flush with casing faces (where applicable). Refer fig's 401, 403, 405, 406, 408, 410, 411, 413, 415, 416, 420, 421, 423, 425, 426, 428 and 430 (as applicable). Do not impair casing surfaces.

22) Dimensionally inspect.

Refer fig's 401, 403, 405, 406, 408, 410, 411, 413, 415, 416, 420, 421, 423, 425, 426, 428 and 430 (as applicable).

23) Crack detect.

Refer Overhaul Manual Chapter 72-65-00 Inspection/Check.

24) Locally reprotect repair area(s).

Refer Overhaul Manual Chapter 72-09-02 Repair.

25) Mark appropriate Repair
Instruction number or R.6 AA
to KB (as applicable) on
component adjacent to normal
'assembly of' number using the
vibro-percussion engraving
technique.

Refer Overhaul Manual Chapter 72-09-00 Repair. Refer Table 3. Refer fig's 403, 406, 411, 416 and 421 for identity Location.

5. MATERIAL

COMPONENT

MATERIAL

RR CODE

CASE, ASSEMBLY OF, PRESSURE AND SCAVENGE PUMP CASINGS.

MSRR 8009 ALUMINIUM ALLOY LAE

6. DATA

NONE.

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7. <u>TOOLS</u>

NONE.

8. REPLACEMENT PARTS

| PART NUMBER | DESCRIPTION | QUANTITY | <u>ITEM</u> |
|-------------|---------------|----------|-------------|
| -54/000 | DUCH | 1 | 1 |
| B514800 | BUSH | <u>,</u> | - |
| B514801 | BUSH | 1 | 2 |
| B514802 | BUSH | 1 | 3 |
| B514803 | BUSH | 1 | 4 |
| B514804 | BUSH | 1 | 5 |
| B514805 | BUSH | 1 | 6 |
| B514806 | BUSH | 1 | 7 |
| B514807 | BUSH | 1 | 8 |
| B515015 | BUSH | 1 | 9 |
| B515016 | BUSH | 1 | 10 |
| B515017 | BUSH | Ž | 11 |
| | BUSH | 2 | 12 |
| B515018 | | . 2 | 13 |
| B515019 | BUSH | | |
| 8515020 | BUSH | 2 | 14 |
| B515687 | BUSH | 1 | 15 |
| B515688 | BUSH | 1 | 16 |
| в515689 | BUSH | 2 | 17 |
| B515690 | BUSH | 2 | 18 |
| B100528 | PLUG, SCREWED | 5 | 19 |
| B424284 | PLUG, SCREWED | 6 | 20 |



TABLE 1

| REPAIR | LOCATION | AMOUNT | DIAMETER AA |
|---|--------------------|---------------|------------------------------|
| INSTRUCTION | | OVERSIZE | |
| NUMBER. | | | |
| | | | |
| B514883 | Α | 0.005 (0,13) | 1.1550/1.1558 (29,34/29,36) |
| | (REFER FIG.401) | 0 010 (0 35) | 1.1600/1.1608 (29,46/29,48) |
| | F14.4017 | 0.010 (0,23) | 1:1000/1:1000 (27,40/27,40/ |
| 8514884 | В | 0.005 (0.13) | 1.1550/1.1558 (29,34/29,36) |
| | (REFER | | |
| : | FIG.401) | 0.010 (0,25) | 1.1600/1.1608 (29,46/29,48) |
| | | 0.005.45.45 | 4 4555 (55 7(155 7(1) |
| B514885 | C | 0.005 (0,13) | 1.1550/1.1558 (29,34/29,36) |
| | (REFER FIG.406) | 0 010 (0 25) | 1.1600/1.1608 (29,46/29,48) |
| | 114.4007 | 0.010 (0)233 | 1110007 111000 (27,40727,407 |
| B514886 | D | 0.005 (0,13) | 1.1550/1.1558 (29,34/29,36) |
| | (REFER | | |
| | FIG.406) | 0.010 (0,25) | 1.1600/1.1608 (29,46/29,48) |
| 7544007 | | 0.005 (0.17) | 1.1550/1.1558 (29,34/29,36) |
| B514887 | E (REFER | יננו,ט) כטט.ט | 1.1550/1.1558 (29,54/29,50) |
| | FIG.411) | 0.010 (0.25) | 1.1600/1.1608 (29,46/29,48) |
| | | | |
| B514888 | F | 0.005 (0,13) | 1.1550/1.1558 (29,34/29,36) |
| | CREFER | | |
| | FIG.411) | 0.010 (0,25) | 1.1600/1.1608 (29,46/29,48) |
| B514889 | G | 0.005 (0,13) | 1.1550/1.1558 (29,34/29,36) |
| 1 | (REFER | | |
| | FIG.416) | 0.010 (0,25) | 1.1600/1.1608 (29,46/29,48) |
| | | | |
| B514890 | H | 0.005 (0,13) | 1.1550/1.1558 (29,34/29,36) |
| | (REFER FIG.416) | 0 010 (0 35) | 1.1600/1.1608 (29,46/29,48) |
| | 110.4107 | 0.010 (0,23) | 1.1000/1.1808 (29,46/29,40/ |
| B514891 | I | 0.005 (0.13) | 1.1550/1.1558 (29,34/29,36) |
| | (REFER | 1 | |
| ! | FIG.421) | 0.010 (0,25) | 1.1600/1.1608 (29,46/29,48) |
| DE4/802 | | 0.005 (0.43) | 0 9050/0 9059 (20 /5/20 /7) |
| B514892 | (REFER | 0.005 (0,13) | 0.8050/0.8058 (20,45/20,47) |
| | FIG. 421) | 0.010 (0,25) | 0.8100/0.8108 (20,57/20,59) |
| | | | |
| B514893 | K | 0.005 (0,13) | 0.8050/0.8058 (20,45/20,47) |
| | (REFER | | 0.0400.40.0400.400.57470.50 |
| | FIG. 426) | 0.010 (0,25) | 0.8100/0.8108 (20,57/20,59) |
| | 1 | <u> </u> | DEPAT |

REPAIR

72-65-00 Repair No. 6 Page 406 Sep 30/94 MK.610-14-28 SP

TABLE 2

| REPAIR | LOCATION | AMOUNT | BUSHING | LOCKING PIN |
|-----------------|--------------------|--------------|----------|-------------|
| INSTRUCTION | COUNTION | OVERSIZE | SLEEVE | REQUIRED |
| NUMBER. | | OVEROILE | REQUIRED | KEGOIKED |
| NO IIDEX • | | | | |
| B514883 | A | 0.005 (0,13) | B514800 | B100528 |
| | (REFER | | | |
| | FIG.401) | 0.010 (0,25) | B514801 | B100528 |
| | | | | |
| B514884 | 8 | 0.005 (0,13) | B515015 | B100528 |
| | (REFER FIG.401) | 0.010 (0,25) | B515016 | B100528 |
| | 110.4017 | 0.010 (0,23) | 010010 | 0100720 |
| B514885 | С | 0.005 (0,13) | B515017 | B424284 |
| | (REFER | | | • |
| | FIG.406) | 0.010 (0,25) | B515018 | B424284 |
| | | | | |
| B514886 | D. | 0.005 (0,13) | 8515687 | B424284 |
| | (REFER | 0.010 (0,25) | B515688 | B424284 |
| | FIG.406) | 0.010 (0,23) | 00001100 | B424204 |
| B514887 | E | 0.005 (0,13) | B515019 | B424284 |
| | (REFER | | | |
| | FIG.411) | 0.010 (0,25) | B515020 | B424284 |
| | | | | |
| B514888 | F | 0.005 (0,13) | B515019 | B424284 |
| | (REFER | 0 040 40 05 | -545030 | |
| | FIG.411) | 0.010 (0,25) | B515020 | B424284 |
| B514889 | G | 0.005 (0,13) | 9515689 | B424284 |
| 3 1 4 0 0 7 | (REFER | 0.003 (0,13) | 3313007 | 0727207 |
| | FIG.416) | 0.010 (0,25) | B515690 | 8424284 |
| | | | | |
| B514890 | H | 0.005 (0,13) | B515689 | 8424284 |
| | (REFER | | | _,,,,,,, |
| · | FIG.416) | 0.010 (0,25) | B515690 | B424284 |
| B514891 | I | 0.005 (0,13) | B514804 | B100528 |
| 0714071 | (REFER | | 0314004 | 5100320 |
| | FIG. 421) | 0.010 (0,25) | B514805 | B100528 |
| | | • | | |
| B514892 | J | 0.005 (0,13) | 8514802 | B100528 |
| | (REFER | | | -400555 |
| | FIG.421) | 0.010 (0,25) | B514803 | B100528 |
| B514893 | - v | 0.005 (0,13) | B514806 | B100528 |
| 1 0 3 1 4 0 7 3 | (REFER | 0.003 (0.13) | 14800 | 5100720 |
| | FIG.426) | 0.010 (0,25) | B514807 | B100528 |
| | | | | |

REPAIR



MK.610-14-28 snecma OVERHAUL

TABLE 3

| REPAIR INSTRUCTION NUMBER. | LOCATION | AMOUNT OVERSIZE | REPAIR INSTRUCTION IDENTITY MARKING REQUIRED |
|----------------------------------|-------------|--------------------|--|
| B514883 | A (REFER | 0.005 (0,13) | B514883A or R.6 AA |
| | FIG.401) | 0.010 (0,25) | B514883B or R.6 AB |
| B514884 | B (REFER | 0.005 (0,13) | B514884A or R.6 BA |
| | FIG. 401) | 0.010 (0,25) | 85148848 or R.6 BB |
| B514885 | C (REFER | 0.005 (0,13) | B514885A or R.6 CA |
| | FIG. 406) | 0.010 (0,25) | 85148858 or R.6 CB |
| 8514886 | D (REFER | 0.005 (0,13) | B514886A or R.6 DA |
| | FIG. 406) | 0.010 (0,25) | B514886B or R.6 DB |
| B514887 | E (REFER | 0.005 (0,13) | B514887A or R.6 EA |
| | FIG.411) | 0.010 (0,25) | B514887B or R.6 EB |
| B514888 | F (REFER | 0.005 (0,13) | B514888A or R.6 FA |
| | FIG.411) | 0.010 (0,25) | B514888B or R.6 FB |
| 8514889 | G (REFER | 0.005 (0,13) | B514889A or R.6 GA |
| 1 | FIG.416) | 0.010 (0,25) | B514889B or R.6 GB |
| B514890 | H (REFER | 0.005 (0,13) | B514890A or R.6 HA |
| | FIG.416 | 0.010 (0,25) | B514890B or R.6 HB |
| B514891 | I (REFER | 0.005 (0,13) | B514891A or R.6 IA |
| | FIG.421) | 0.010 (0,25) | B514891B or R.6 IB |
| B514892 | J (REFER | 0.005 (0,13) | B514892A or R.6 JA |
| | FIG.421) | 0.010 (0,25) | 85148928 or R.6 J8 |
| B514893 | K (REFER | 0.005 (0,13) | B514893A or R.6 KA |
| | FIG. 426) | 0.010 (0,25) | B514893B or R.6 KB |

REPAIR

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TABLE 4

| REPAIR APPLICABILITY | | | |
|------------------------|---|--|--|
| REPAIR INSTRUCTION No. | COMPONENT PART No. | | |
| B514883 | B473836 | | |
| B514884 | B473836 | | |
| B514885 | B477554 | | |
| B514886 | B477554 | | |
| B514887 | B480941 B480943 | | |
| B514888 | B480941 B480943 | | |
| B514889 | B480939 B477416 | | |
| B514890 | B480939 | | |
| B514891 | B480937 B489184 B489186 B477414 | | |
| B514892 | B480937 B489184 B489186 | | |
| B514893 | B480934 B485980 B485981 B485982 B485983 B485984 B515622 B515623 B515624 | | |

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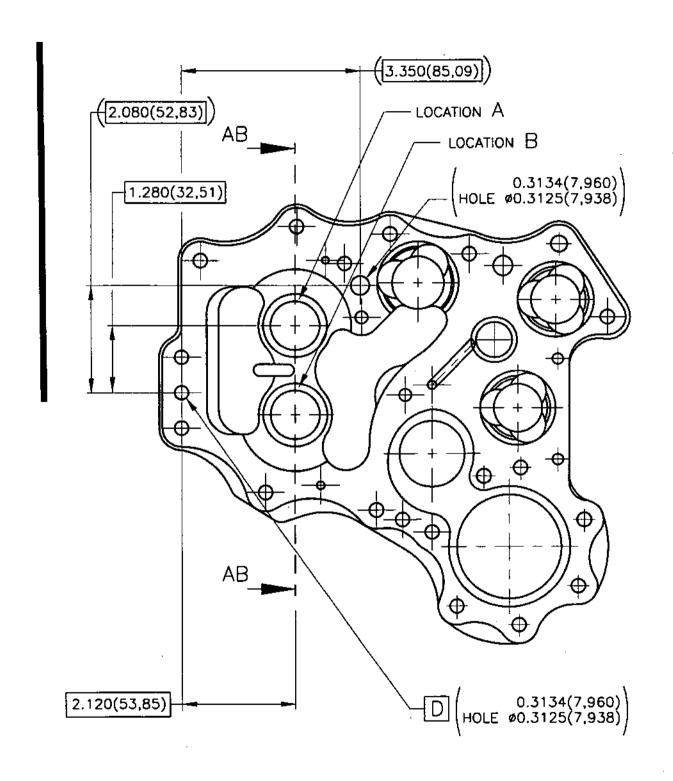
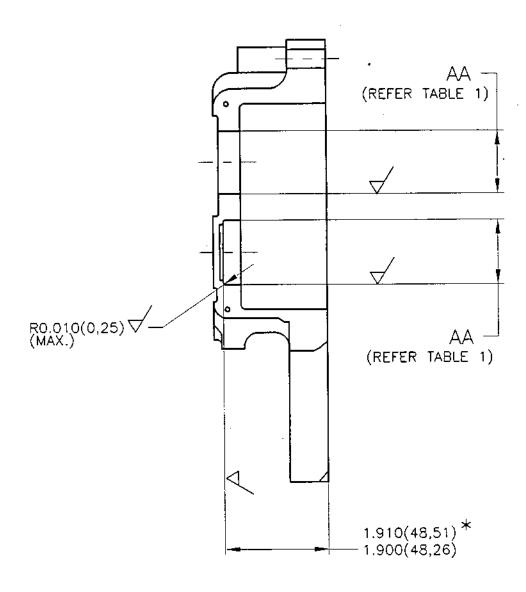


FIG.401

REPAIR

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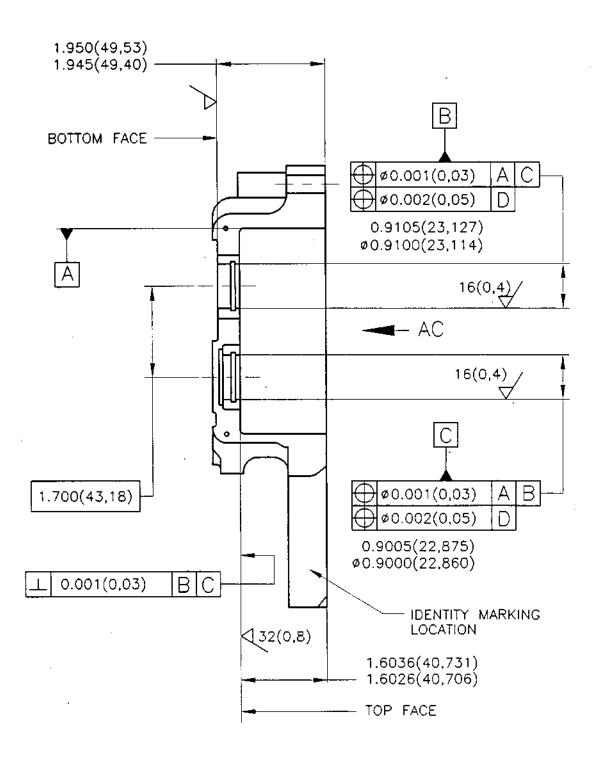


* THIS DIMENSION WAS ORIGINALLY MANUFACTURED AT 1.900(48,26) \pm 0.010(0,25) AND WILL NOT REQUIRE RE-MACHINING IF WITHIN STATED REPAIR DIMENSIONS.

SECTION AB
SHOWING BUSHING SLEEVES REMOVED
FIG.402

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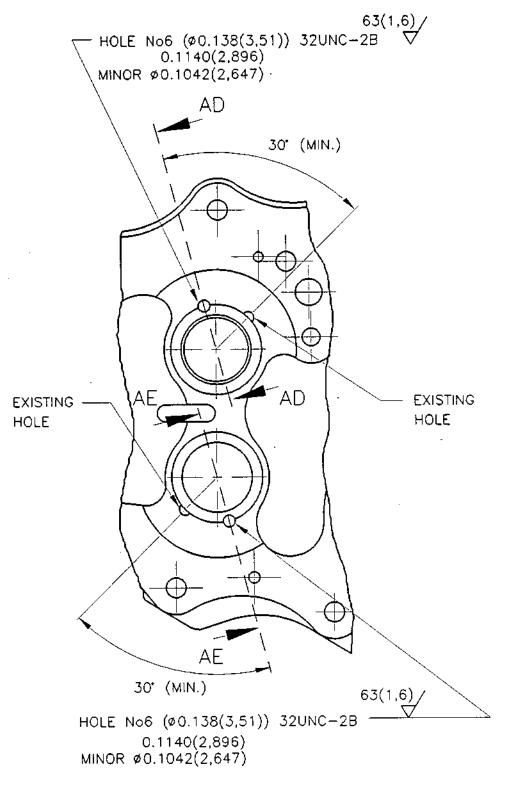


REPEAT SECTION AB SHOWING BUSHING SLEEVES IN POSITION FIG.403

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MK.610-14-28 snecma OVERHAUL



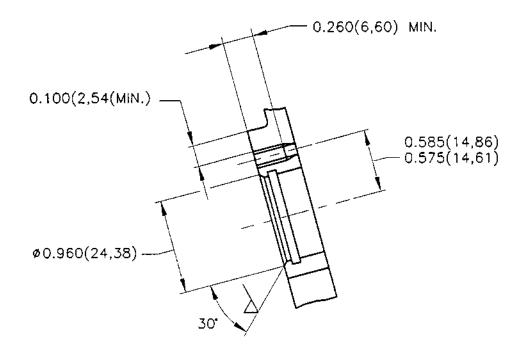
∨ —— AC FIG.404

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SECTION AD

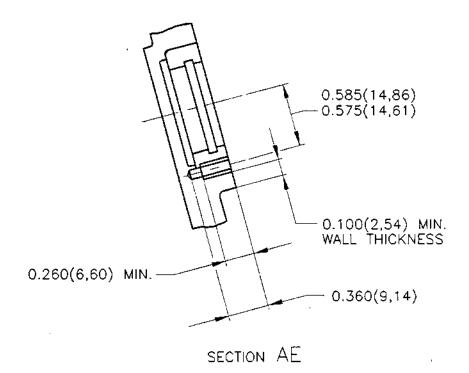


FIG.405

REPAIR 72-65-00 Repair No. 6 Page 414 Sep 30/94

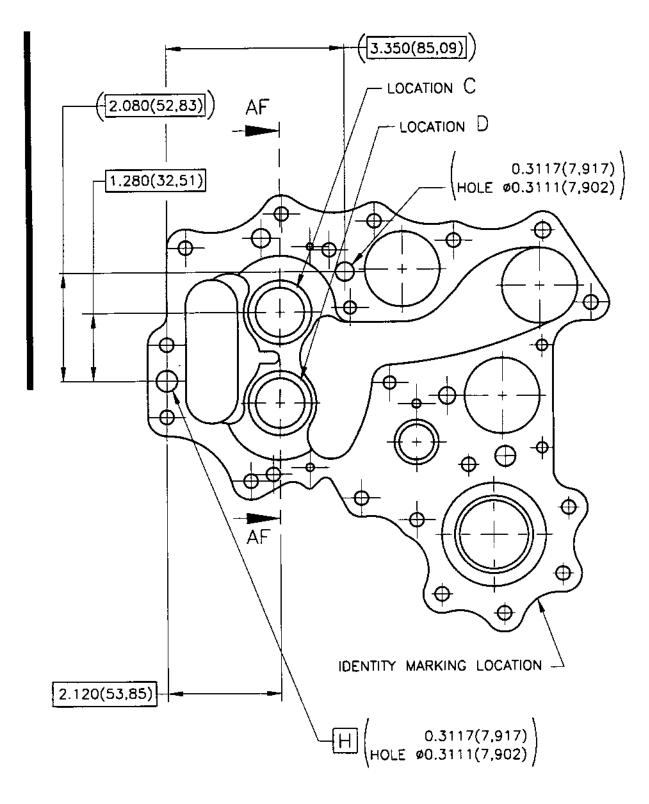


FIG.406

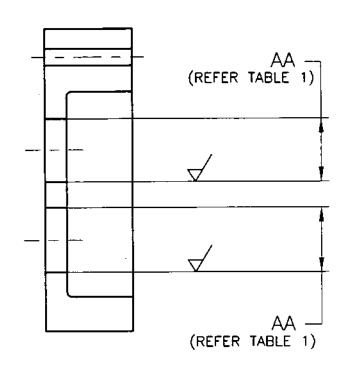
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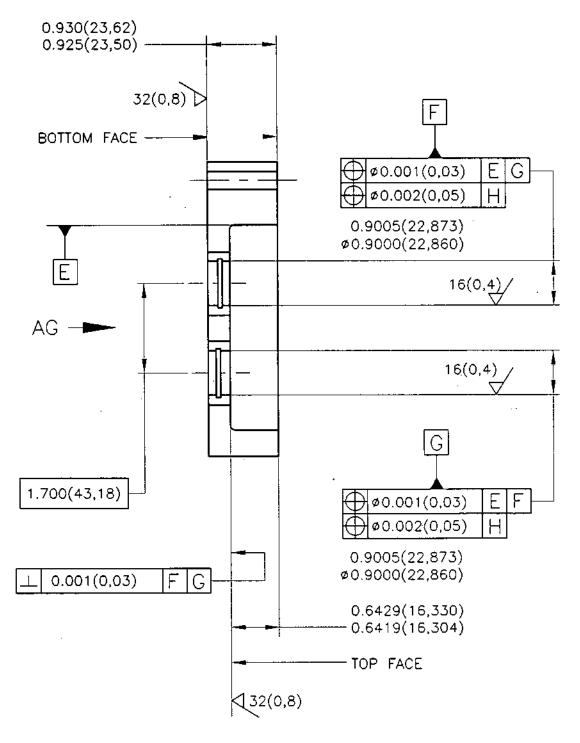
REPAIR





SECTION AF
SHOWING BUSHING SLEEVES REMOVED
FIG.407

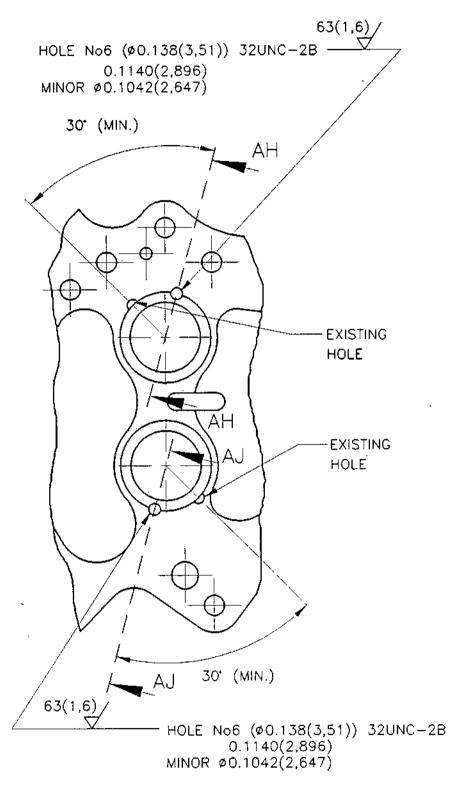
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REPEAT SECTION AF
SHOWING BUSHING SLEEVES IN POSITION
FIG.408

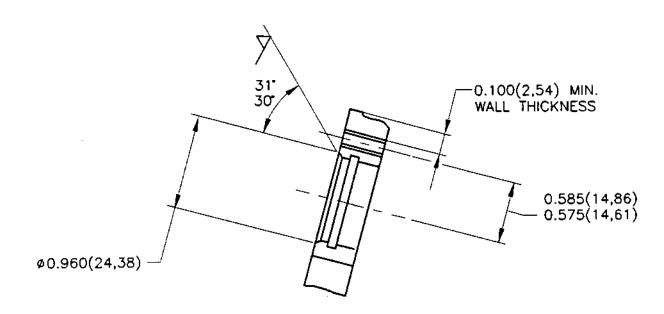
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v — → AG FIG.409

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SECTION AH

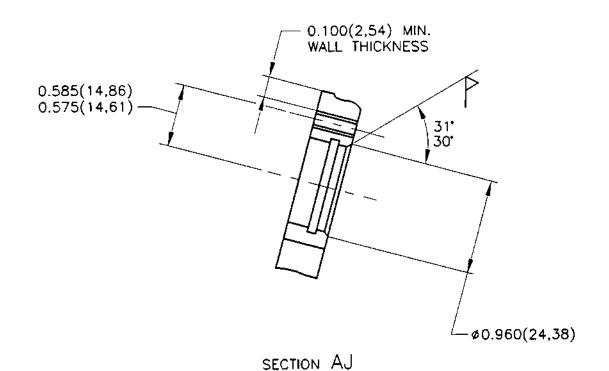
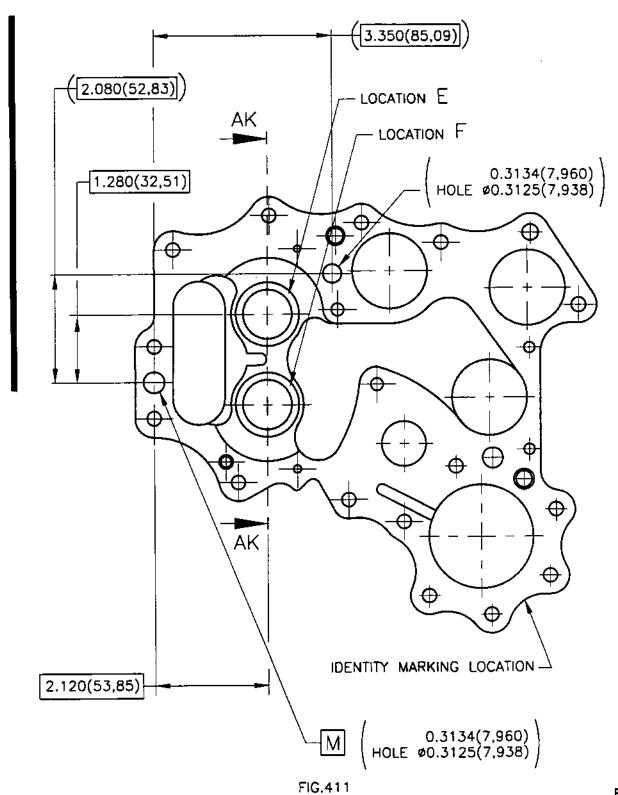


FIG.410

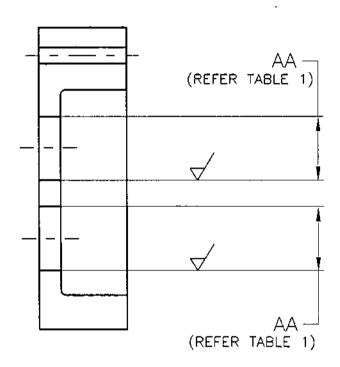
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REPAIR

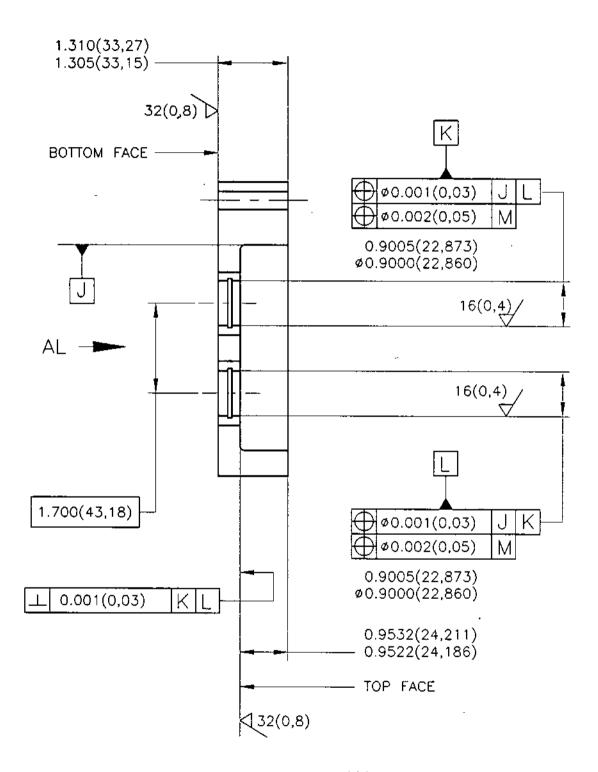
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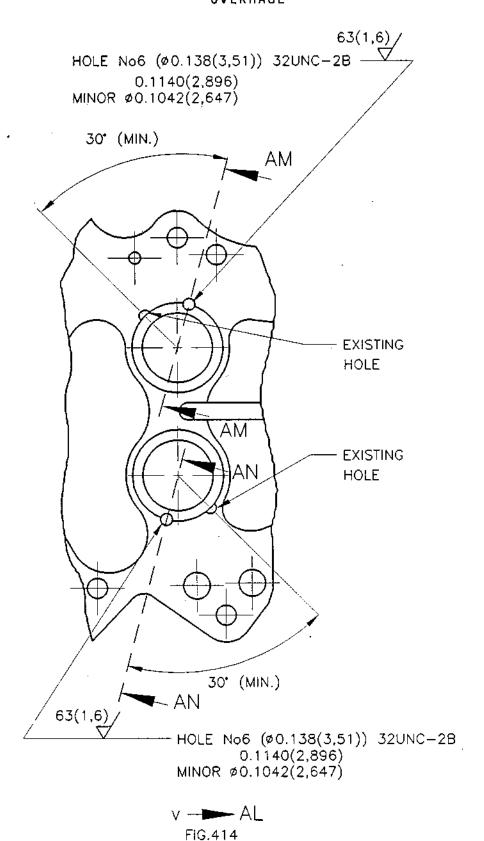
SECTION AK
SHOWING BUSHING SLEEVES REMOVED
FIG.412





REPEAT SECTION AK
SHOWING BUSHING SLEEVES IN POSITION
FIG.413

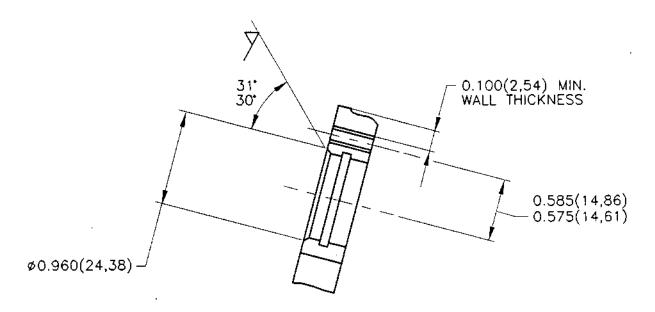
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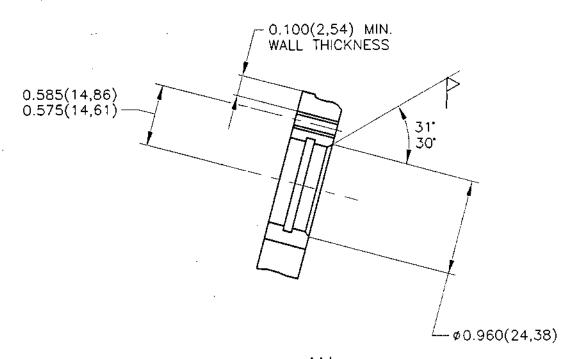
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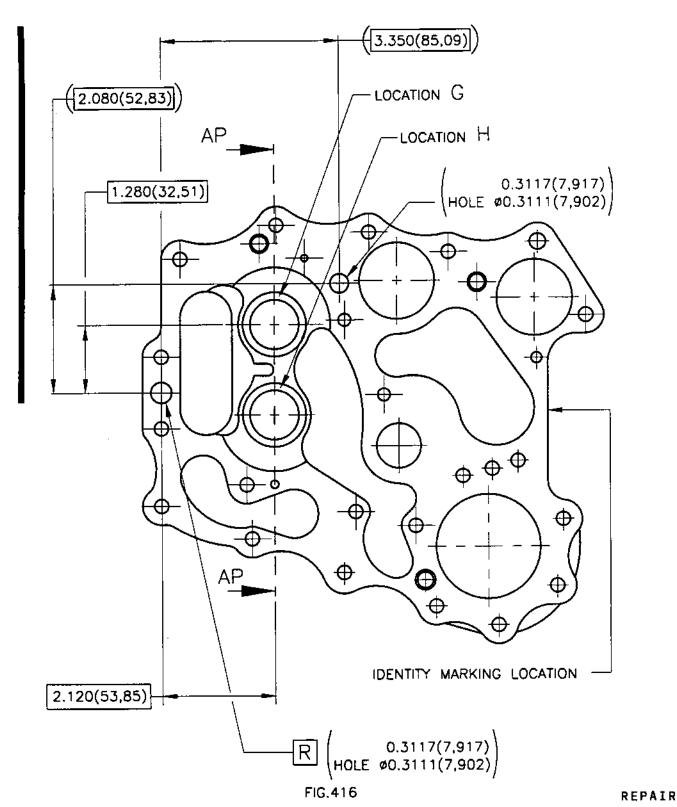
SECTION AM



SECTION AN

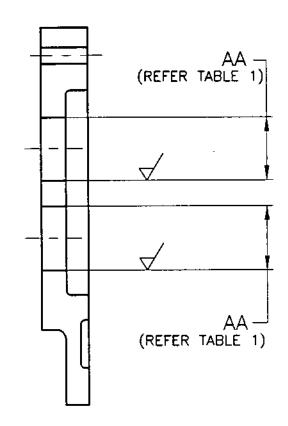
FIG.415

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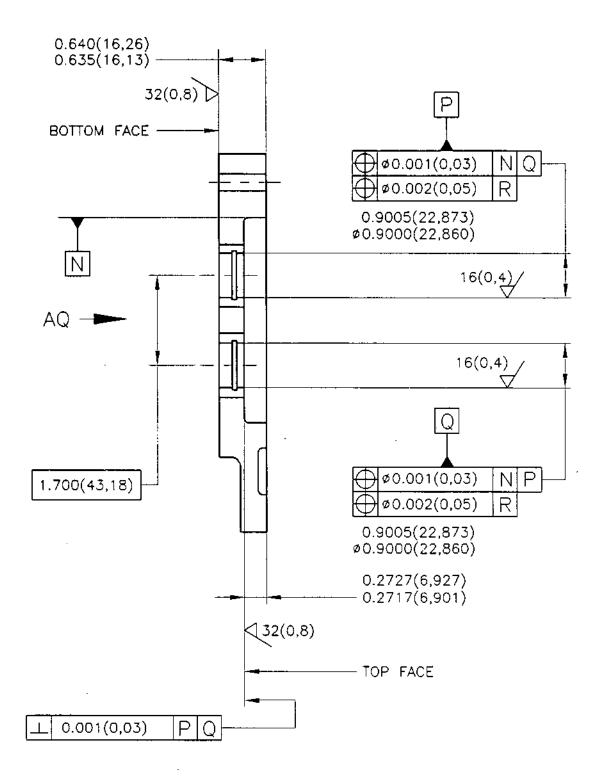




SECTION AP
SHOWING BUSHING SLEEVES REMOVED
FIG.417

REPAIR 72-65-00 Repair No. 6 Page 426 Sep 30/94

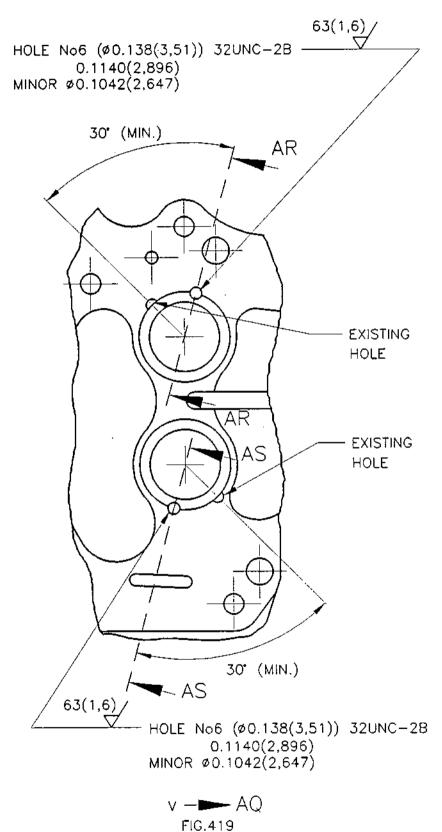




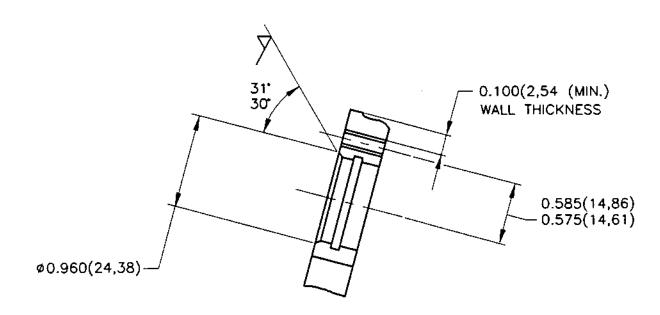
REPEAT SECTION AP SHOWING BUSHING SLEEVES IN POSITION FIG.418

REPAIR 72-65-00 Repair No. 6 Page 427 Sep 30/94

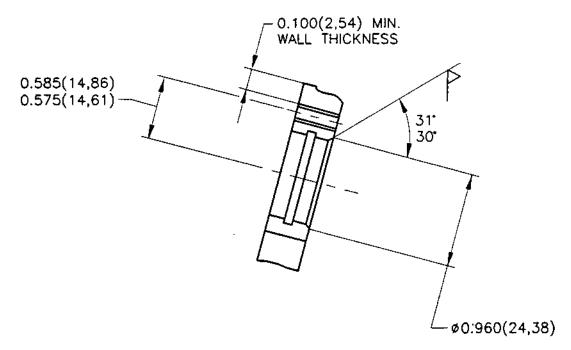




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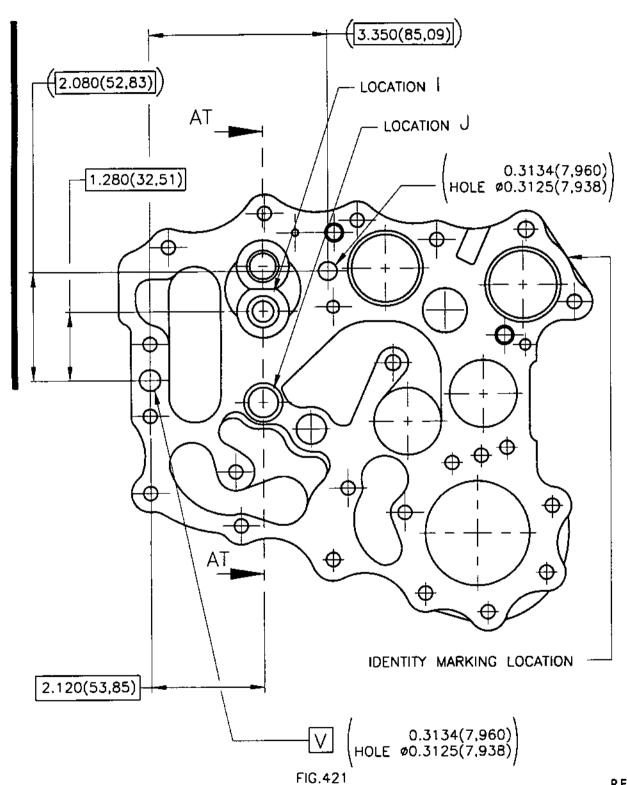


SECTION AR



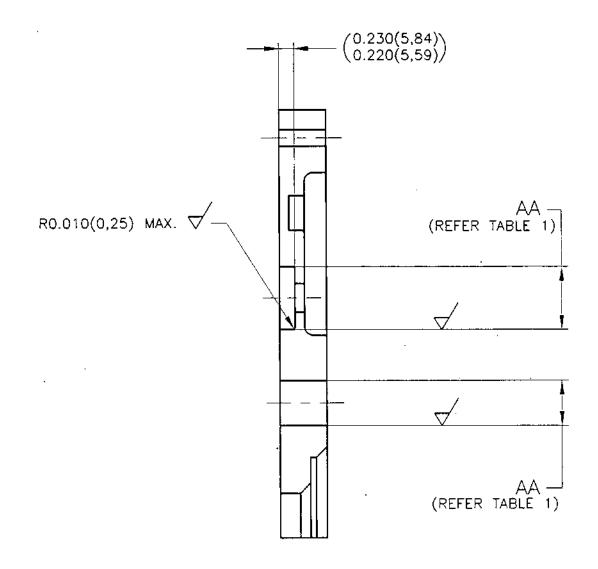
SECTION AS

FIG.420



REPAIR

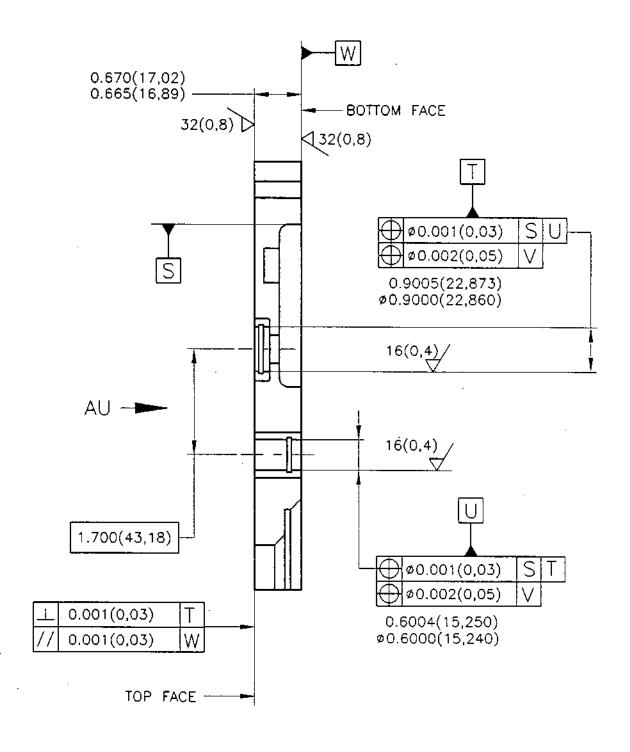
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SECTION AT SHOWING BUSHING SLEEVES REMOVED FIG.422

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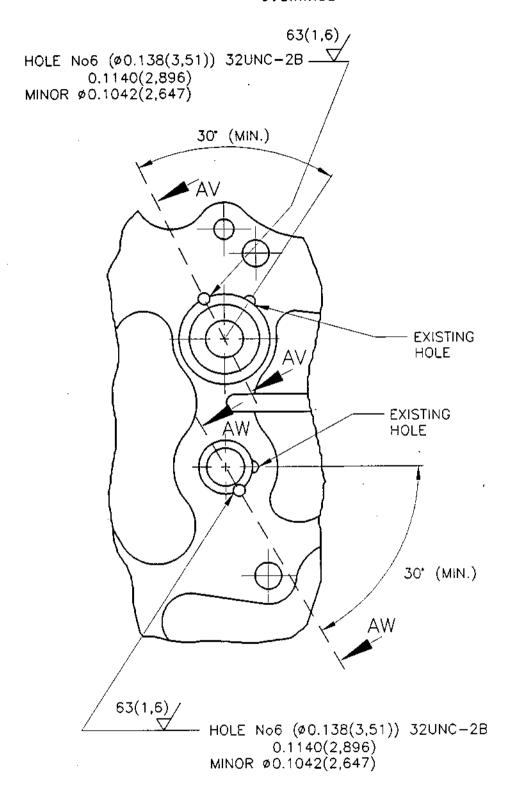


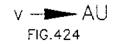
REPEAT SECTION AT SHOWING BUSHING SLEEVES IN POSITION FIG.423

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OVERHAUL

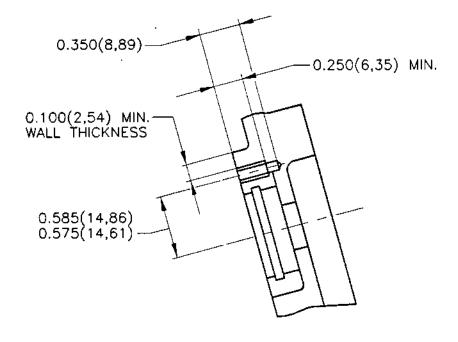




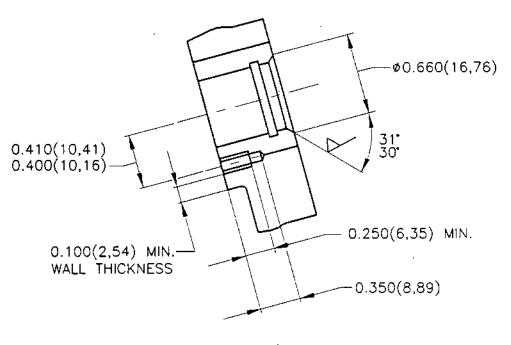
REPAIR

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SECTION AV



SECTION AW

FIG.425

REPAIR 72-65-00 Repair No. 6 Page 434 Sep 30/94

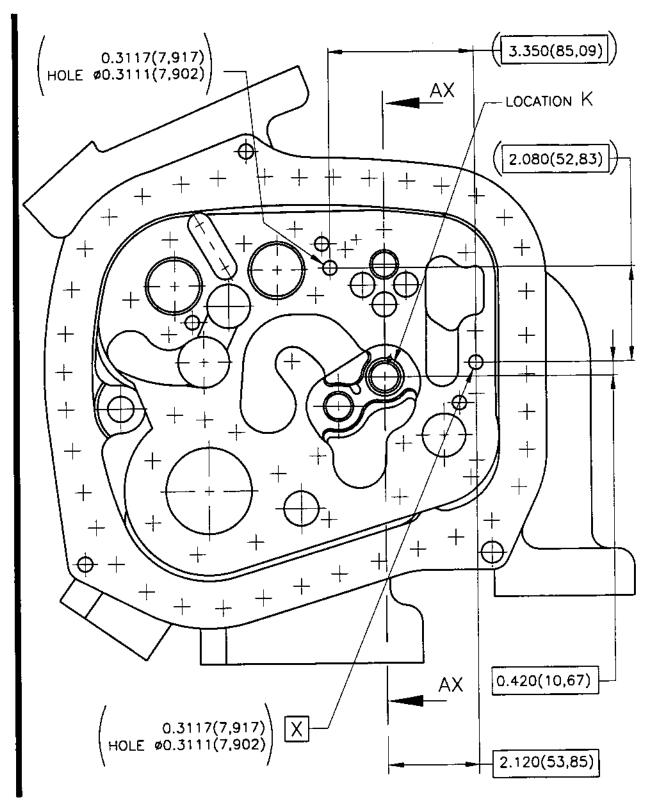
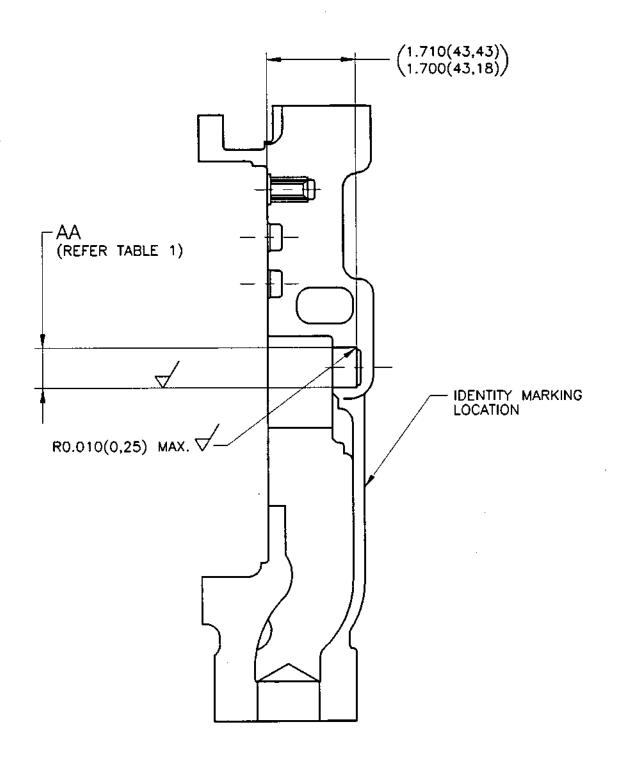


FIG.426

REPAIR

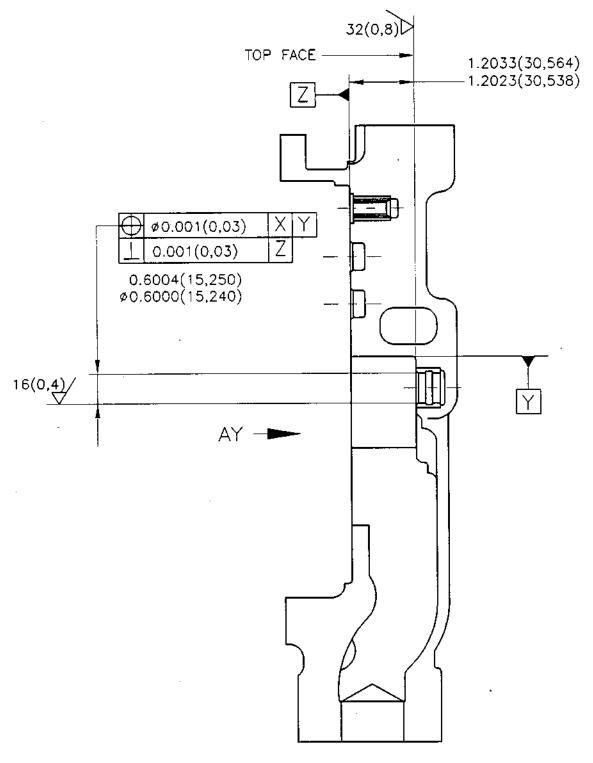
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SECTION AX SHOWING BUSHING SLEEVE REMOVED FIG.427

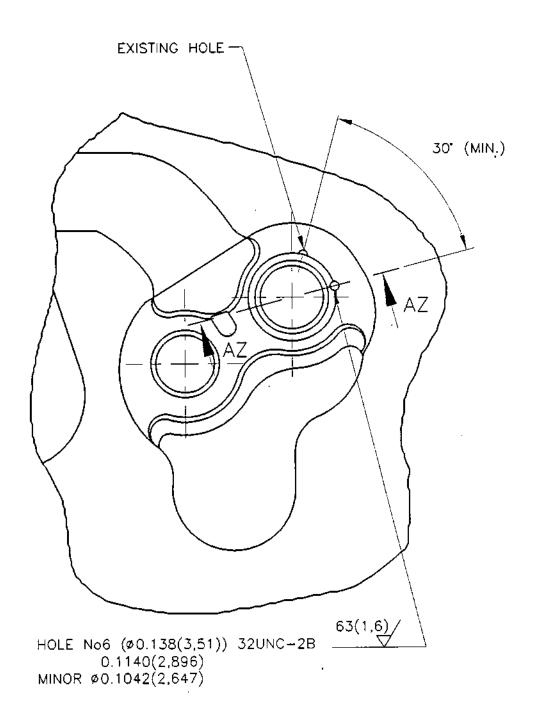
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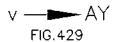


REPEAT SECTION AX SHOWING BUSHING SLEEVE IN POSITION FIG.428

REPAIR

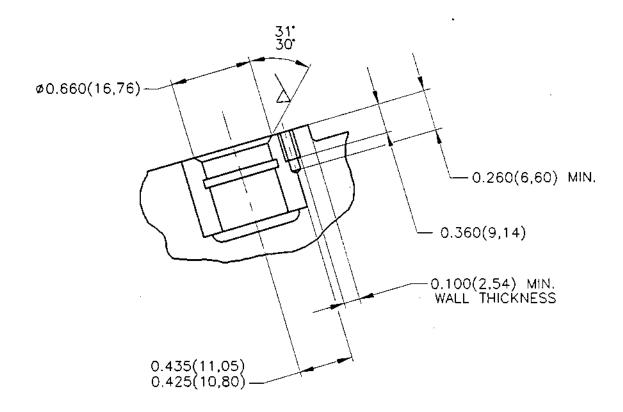
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SECTION AZ FIG.430



Printed in England

MK.610-14-28 OVERHAUL

snecma

CHAPTER 72

SPECIAL TOOLS, FIXTURES AND EQUIPMENT

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| HP Compressor Assembly | | | 72-33-01 |
| HP Compressor Case and Vanes | • • • | | 72-33-02 |
| HP Compressor Rotor | • • • | | 72-51-03 |
| HP Turbine Rotor | • • • | | 72-52-01 |
| LP Turbine Nozzle | • • • | • • • | 72-52-02 |
| LP Turbine Rotor | • • • | • • • | 72-52-03 |
| LP Turbine Bearing Support | • • • | • • • | 72-53-00 |
| Turbine Exhaust Diffuser | • • • | • • • | 72-62-00 |
| Left-hand Gearbox | • • • | • • • | 72-63-00 |
| Right-hand Accessory Gearbox | • • • | • • • | 72-65-00 72-65-00 |
| Main Oil Pump | • • • | • • • | 12-05-00 |

SPECIAL TOOLS ETC.

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ENGINE - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble the engine to its main sub-assemblies, and to assemble the main sub-assemblies to form the (bare) basic engine.
- B. The tools have been listed in order of usage, and the Tool Ref. No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul, and will be duplicated in the tables.
- C. Pictorial views of the tools are illustrated and reference to the relevant Fig.No. is included in the tables.

2. Engine Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| 1973 | PJ.894664 | Lifting equipment, turbine exhaust diffuser | 1001 |
| 1974 | PT.1050096 | Extension bar | 1001 |
| 1230 | PJ.861896 | Support platform, turbine exhaust diffuser | 1001 |
| * 437 | P3¢.1086733 | Protector, turbine exhaust diffuser | 1001 |
| 1138 | PJ.850924 | Protector, LP turbine hub labyrinth | 1001 |
| * 927 | P3C.1229246 | Immobiliser, LP drive shaft | 1001 |
| *1261 | P3C.863691 | Centralising fixture, LP drive shaft | 1002 |
| *1513 | P3C.1076009 | Spanner wrench, LP signal system nut | 1002 |
| *1617 | P3C.871370 | Spanner wrench, LP signal system guide | 1002 |
| *1300 | P3C.869240 | Adapter, torque multiplier (1022)/immobiliser | 1002 |

Disassembly Tools
Table 1001 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|----------------------------|--|--------------|
| *1022 | P3C.684642 | Torque multiplier, spanner wrench (929 and 1594) | 1002 |
| * 929 *1651 | P3C.1229270 P3C.334809 | Spanner wrench, LP signal system Handle, torque multiplier (1022, 1647 and 1333) | 1002 1003 |
| 1378 | POJ.1077509 | Container, LP signal shaft and generating mechanism items | 1003 |
| * 862 *1578 | P3C.1212179 P3C.1229386 | Immobiliser, LP turbine hub Spanner wrench, LP turbine hub nut | 1003 1003 |
| *1647 | T.279767 | Torque multiplier, spanner wrench (1578 and 1616) | 1003 |
| *1616 | P3C.869300 | Spanner wrench, LP turbine bearing nut | 1003 |
| *1180 | P3C.857396 | Protector, LP turbine assembly | 1004 |
| *1142 | P3C.850928 | Lifting/extracting fixture, LP turbine/hub | 1004 |
| 1134 | P3C.699980 | Protector, LP turbine front labyrinth | 1004 |
| 1012 | PJ.1246960 | Support, LP turbine | 1004 |
| 1014 | P3C.690045 | Pallet, LP and HP turbine | 1004 |
| *1013 | PJ.1255652 | Steady, LP drive shaft | 1004 |
| *1192 | P3C.858919 | Multiple leg sling, LP turbine nozzle | 1005 |
| *1061 | P3C.695746 | Protector, HP turbine rear labyrinth | 1005 |
| *1354 | P3C.899008 | Immobiliser, HP turbine | 1005 |
| *1630 | PJ.898073 | Spanner wrench, HP turbine hub | 1005 |
| 1247 | P3C.1263649 | Mechanical puller, HP turbine rear labyrinth | 1005 |
| *1120 | P3C.699964 | Lifting fixture, HP turbine rotor | 1005 |
| 979 | PJ.1246961 | Support, HP turbine | 1006 |
| *1058 | P3C.695743 | Split sleeve, LP drive shaft | 1006 |
| 106 | PJ.1050185 | Multiplier/adapter, HP turbine hub | 1006 |
| 105 | PJ.1050184 | Immobiliser, HP turbine hub | 1006 |
| *1315 | P3C.892955 | Adapter, HP turbine hub/ immobiliser (105) | 1006 |
| 107 | PJ.1050186 | Spanner wrench, HP turbine hub | 1006 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|--|------|
| 1297 | PJ.869213 | Drilling jig, HP turbine hub nut | 1007 |
| 1057 | P3C.6957.40 | Lifting/extracting fixture, HP turbine hub | 1007 |
| 1063 | P3C.695748 | Protector, HP turbine front labyrinth | 1007 |
| 1062 | P3C:695747 | Protector, HP turbine hub labyrinth | 1007 |
| *1202 | P3C.858987 | Guide sleeve, HP drive shaft | 1007 |
| 1310 | P3C.892661 | Lifting fixture, C.C.O.C./ compressor diffuser case | 1007 |
| 1183 | P3C.858915 | Adapter ring, C.C.O.C./compressor diffuser case/lifting fixture (1310) | 1008 |
| *1304 | P3C.871850 | Guide pin, HP compressor/ diffuser case | 1008 |
| 1661 | P3C.523261 | Pallet, compressor diffuser case | 1008 |
| *1237 | P3C.862465 | Protector, HP compressor rear | 1008 |
| *1323 | P3C.893237 | Lifting fixture, LP signal shaft | 1008 |
| * 609 | P3C.1089117 | Split sleeve, LP signal shaft guide | 1008 |
| *1452 | POJ.868978 | Fixture, LP signal shaft tube | 1009 |
| 1979 | PJ.1259779 | Extraction claw (1019) | 1009 |
| *1019 | P3C.1244800 | Mechanical puller, HP turbine bearing inner track | 1009 |
| 248 | P3C.1072888 | Bearing, slave, HP compressor rear bearing adapter (1028) | 1009 |
| 973 | P3C.1234441 | Setting pointer, LP signal shaft | 1009 |
| 579 | P3C.1089046 | Locking tube, slave, LP drive shaft | 1009 |
| 980 | P3C.1234442 | Split sleeve, slave locking tube (579) support | 1010 |
| * 981 | P3C.1234443 | Lifting fixture, LP drive shaft | 1010 |
| 580 | P3C.1089047 | Container, slave locking tube (579) | 1010 |
| 402 | P3C.1083348 | Split sleeve, LP drive shaft support | 1010 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 1574 | P3C.1244614 | Crank ring wrench, HP drive shaft labyrinth | 1010 |
| 1668 | T.914825 | Puller, HP drive shaft labyrinth | 1010 |
| 1239 | PJ.862841 | Protector, HP drive shaft labyrinth | 1011 |
| 1051 | P3C.695730 | Beam type sling, rear bearing adapter (1041) | 1011 |
| 1041 | P3C.695724 | Rear bearing adapter, HP compressor | 1011 |
| 391 | P3C.1083275 | Spacer sleeve, LP drive shaft | 1011 |
| 1042 | P3C.695726 | Nut, slave, LP drive shaft | 1011 |
| 1043 | P3C.695727 | Lifting fixture, HP compressor | 1011 |
| 1028 | P3C.695702 | Rear bearing adapter, (balancing) HP compressor | 1012 |
| 1054 | P3C.695736 | Multiple leg sling, rear bearing adapter (1028) | 1012 |
| 389 | P3C.1083273 | Spacer, slave, LP drive shaft | 1012 |
| 1036 | P3C.695712 | Mobile stand, HP compressor/ intermediate case | 1012 |
| 1039 | P3C.695720 | Lifting fixture, HP compressor | 1012 |
| 1200 | P3C.858985 | Packing, slave, LP compressor rear case | 1012 |
| 1201 | P3C.858986 | Packing, slave, LP compressor rear case | 1013 |
| 1244 | P3C.863609 | Build/strip base, engine vertical position | 1013 |
| 1569 | P3C.1094706 | Spanner wrench, labyrinth/bearing housing | 1013 |
| *1541 | P3C.1094707 | Spanner wrench, labyrinth/bearing housing | 1013 |
| * 396 | P3C.1083282 | Support steady, LP drive shaft | 1013 |
| 1227 | P3C.860767 | Protector, LP compressor rear | 1013 |
| 1011 | P3C.1255621 | Rear bearing adapter, LP compressor (alt. to 344) | 1014 |
| *1096 | P3C.699914 | Lifting fixture, rear bearing adapter | 1014 |
| 344 | P3C.1076092 | Rear bearing adapter, LP compressor (alt. to 1011) | 1014 |
| 398 | P3C.1083294 | Case, slave, exit guide blade | 1014 |

Disassembly Tools Table 1001 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | | FIG. |
|-----------------|--------------------------|---|------|
| 559 | PJ.1229381 | Bolt, slave, case (398) | 101 |
| *1330 | P3C.893238 | Immobiliser, LP compressor probe | 101 |
| *1333 | P3C.893963 | Multiplier, spanner wrench (325) | 101 |
| 325 | P3C.1073286 | SPANNER WRENCH, LP compressor probe ring nut | 101 |
| * 696 | P3C.1263656 | Sleeve, LP compressor | 101 |
| * 280 | P3C.1073102 | Immobiliser, LP compressor bearing nut | 101 |
| 1594 | P3C.699924 | Spanner wrench, LP compressor rear bearing | 101 |
| *1551 | P30.1212107 | Hand spanner, LP compressor bevel gear retaining nut | 101 |
| * 283 | P3C.1073105 | Mechanical puller, LP compressor rear bearing | 101 |
| 1198 | P3C.858964 | Retainer, LP compressor rear bearing | 101 |
| 345 | PJ.1076094-100 | Spacer ring, LP compressor rotor shaft rear | 101 |
| 346 | PJ.1076093 | Bearing, slave, LP compressor rear (344) | 101 |
| *1099 | P3C.699918 | Mechanical driver, LP compressor slave rear bearing | 101 |
| 1100 | P3C.699922 | Packing piece, LP compressor | 101 |
| 1658 | T.520387 | Torque wrench, multiplier (1022) | 101 |
| 1288 | P3C.867500 | Bearing, slave, LP compressor front (588) | 101 |
| 588 | P3C.1089083 | Front bearing adapter, LP compressor | 101 |
| 1106 | P3C.699934 | Adjustable support, LP compressor | 101 |
| 1105 | P3C.699931 | Mobile stand, LP compressor | 101 |
| * 319 | P5J.1266441 | Adapter, jacking, LP compressor rotor | 101 |
| *1236 | P3C_862345 | Lifting fixture, air inlet section | |
| 3165 | \$3\$20432000 | Extractor set, signal tube from LP compressor drive shaft | 102 |

Disassembly Tools Table 1001 (Concluded)

SPECIAL TOOL ETC.

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3. Engine Assembly Tools

| 967 P3C.1234419 Platform, engine vertical build 1018 85 P3C.1050005 Mobile stand, stow build 1018 platforms *1236 P3C.862345 Lifting fixture, air inlet section 1018 *1244 P3C.863609 Building/strip base, engine 1013 vertical build *1096 P3C.699914 Lifting fixture, LP compressor 1014 assembly *199 P5J.1266441 Adapter, jacking, LP compressor 1017 rotor 1369 P3C.1062824 Protector, LP compressor front 1018 bearing adapter *199 P3C.1063656 Spanner wrench, LP compressor 1015 bearing nut 1018 *1594 P3C.699924 Spanner wrench, LP compressor 1015 rear bearing *1022 P3C.684642 Torque multiplier, spanner wrench 1006 (1594) *1651 P3C.334809 Handle, torque multiplier (1022) 1006 rear bearing 284 P3C.1073105 Mechanical puller, LP compressor 1018 *1099 P3C.699918 Mechanical driver, LP compressor 1018 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1018 bearing 1018 *1330 P3C.893238 Immobilizer, LP compressor 1018 ring nut 1333 P3C.893963 Multiplier, spanner wrench (325) 1018 *1333 P3C.893963 Multiplier, spanner wrench (325) 1018 *1333 P3C.893961 Multiplier, spanner wrench (325) 1018 *1227 P3C.860767 Protector, LP compressor rear 1018 PJ.1065974 Protector, HP compressor rear 1019 PJ.1065974 Protector, HP compressor Page 1019 PJ.1065974 Protector, HP compressor Page 1019 PJ.1065974 Protector, HP com | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|--|-----------------|--------------------------|--|--------------|
| #1236 P3C.1050005 Mobile stand, stow build platforms #1244 P3C.863609 Building/strip base, engine vertical build #1096 P3C.699914 Lifting fixture, LP compressor lold assembly # 319 P5J.1266441 Adapter, jacking, LP compressor lolf rotor 1369 P3C.1062824 Protector, LP compressor front lols bearing adapter # 696 PJ.1263656 Sleeve, rotor shaft rear lolf bearing nut # 1594 P3C.699924 Spanner wrench, LP compressor lolf rear bearing # 1022 P3C.684642 Torque multiplier, spanner wrench (1594) # 1651 P3C.334809 Handle, torque multiplier (1022) lood (1594) # 1651 P3C.334809 Handle, torque multiplier (1022) lood rear bearing # 1099 P3C.699918 Mechanical puller, LP compressor lold wechanical driver, LP compressor lold bearing # 1551 P3C.1073106 Adapter, mechanical driver (1099) lold wechanical driver, LP compressor lold bearing # 1551 P3C.1212107 Wrench spanner, LP compressor lold bearing # 1330 P3C.893238 Immobilizer, LP compressor probe ring nut # 1333 P3C.893963 Multiplier, spanner wrench (325) lold p3C.8939012 Checking gauge, LP compressor lold PJ.1065974 Protector, LP compressor rear lold PJ.1065974 Protector PJ.106 | | | Platform, engine vertical build | 1018 |
| *1236 | | | Mobile stand, stow build | 1018 |
| *1096 P3C.699914 Lifting fixture, LP compressor lol4 assembly * 319 P5J.1266441 Adapter, jacking, LP compressor lol7 rotor 1369 P3C.1062824 Protector, LP compressor front bearing adapter * 696 PJ.1263656 Sleeve, rotor shaft rear lol5 bearing nut * 1594 P3C.699924 Spanner wrench, LP compressor lol5 rear bearing * 1022 P3C.684642 Torque multiplier, spanner wrench (1594) * 1651 P3C.334809 Handle, torque multiplier (1022) loo3 rear bearing 284 P3C.1073105 Mechanical puller, LP compressor lol6 rear bearing 284 P3C.1073106 Adapter, mechanical driver (1099) lol6 bearing * 1099 P3C.699918 Mechanical driver, LP compressor lol6 bearing * 1330 P3C.893238 Immobilizer, LP compressor probe lol7 ring nut * 1333 P3C.89326 Multiplier, spanner wrench (325) lol7 probe ring nut * 1333 P3C.893963 Multiplier, spanner wrench (325) lol7 protector, LP compressor rear lol7 PJ.1065974 PJ.106 | | | Lifting fixture, air inlet section Building/strip base, engine | 1018 1013 |
| * 319 P5J.1266441 Adapter, jacking, LP compressor rotor 1369 P3C.1062824 Protector, LP compressor front bearing adapter * 696 PJ.1263656 Sleeve, rotor shaft rear lols bearing nut * 1594 P3C.699924 Examing the part of th | *1096 | P3C.699914 | Lifting fixture, LP compressor | 1014 |
| bearing adapter * 696 | * 319 | P5J.1266441 | Adapter, jacking, LP compressor | 1017 |
| * 280 P3C.1073102 Immobilizer, LP compressor bearing nut *1594 P3C.699924 Spanner wrench, LP compressor rear bearing *1022 P3C.684642 Torque multiplier, spanner wrench 1002 (1594) *1651 P3C.334809 Handle, torque multiplier (1022) 1003 * 283 P3C.1073105 Mechanical puller, LP compressor 1016 * 284 P3C.1073106 Adapter, mechanical driver (1099) 1018 * 1099 P3C.699918 Mechanical driver, LP compressor 1016 * bearing * 1551 P3C.1212107 Wrench spanner, LP compressor 1018 * bevel gear retaining nut * 1330 P3C.893238 Immobilizer, LP compressor probe 1018 * 1331 P3C.893963 Multiplier, spanner wrench (325) 1018 * 1227 P3C.860767 Protector, LP compressor rear 1018 * 1227 P3C.860767 Protector, LP compressor rear 1018 * 1227 P3C.860767 Protector, LP compressor 1018 * 1228 P3C.899012 Checking gauge, LP compressor 1018 * 1229 P3C.809012 Checking gauge, LP compressor 1018 * 1220 P3C.809012 Checking gauge, LP compressor 1018 | 1369 | P3C.1062824 | | 1018 |
| bearing nut *1594 P3C.699924 Spanner wrench, LP compressor lols rear bearing *1022 P3C.684642 Torque multiplier, spanner wrench lood (1594) *1651 P3C.334809 Handle, torque multiplier (1022) lood *283 P3C.1073105 Mechanical puller, LP compressor lold rear bearing 284 P3C.1073106 Adapter, mechanical driver (1099) lold *1099 P3C.699918 Mechanical driver, LP compressor lold bearing *1551 P3C.1212107 Wrench spanner, LP compressor lold bearing *1330 P3C.893238 Immobilizer, LP compressor probe ring nut *1330 P3C.893238 Immobilizer, LP compressor probe ring nut *1331 P3C.893963 Multiplier, spanner wrench (325) lold *1227 P3C.860767 Protector, LP compressor rear 83 P3C.899012 Checking gauge, LP compressor 210 PJ.1065974 Protector, HP compressor rear | * 696 | PJ.1263656 | Sleeve, rotor shaft rear | 1015 |
| rear bearing *1022 P3C.684642 Torque multiplier, spanner wrench 1002 (1594) *1651 P3C.334809 Handle, torque multiplier (1022) 1003 rear bearing 284 P3C.1073105 Mechanical puller, LP compressor 1016 bearing *1099 P3C.699918 Mechanical driver, LP compressor 1016 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1016 bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe ring nut *325 P3C.1073286 Spanner wrench, LP compressor 1016 probe ring nut *326 P3C.893963 Multiplier, spanner wrench (325) 1016 protector, LP compressor rear 1017 protector, LP compressor rear 1018 protector, LP compressor rear 1019 protector protec | * 280 | P3C.1073102 | | 1 015 |
| *1022 P3C.684642 Torque multiplier, spanner wrench (1594) *1651 P3C.334809 Handle, torque multiplier (1022) 1003 * 283 P3C.1073105 Mechanical puller, LP compressor 1016 rear bearing 284 P3C.1073106 Adapter, mechanical driver (1099) 1018 *1099 P3C.699918 Mechanical driver, LP compressor 1016 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1016 bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe 1016 ring nut * 325 P3C.1073286 Spanner wrench, LP compressor 1016 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1016 *1227 P3C.860767 Protector, LP compressor rear 1016 83 P3C.899012 Checking gauge, LP compressor 1016 PJ.1065974 Protector, HP compressor rear 1016 | *1594 | P3C.699924 | | 1015 |
| * 283 P3C.1073105 Mechanical puller, LP compressor 1016 rear bearing 284 P3C.1073106 Adapter, mechanical driver (1099) 1018 *1099 P3C.699918 Mechanical driver, LP compressor 1016 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1018 bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe ring nut *325 P3C.1073286 Spanner wrench, LP compressor 1018 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1018 probe ring nut *1333 P3C.893963 Protector, LP compressor rear 1018 p3C.893963 Protector, LP compressor rear 1018 p3C.893964 Protector, LP compressor rear 1018 P3C.899012 Checking gauge, LP compressor 1018 PJ.1065974 Protector, HP compressor rear 1018 | *1022 | P3C.684642 | Torque multiplier, spanner wrench | 1002 |
| rear bearing 284 P3C.1073106 Adapter, mechanical driver (1099) 1018 *1099 P3C.699918 Mechanical driver, LP compressor 1016 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1018 bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe 1016 ring nut *325 P3C.1073286 Spanner wrench, LP compressor 1018 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1018 *1227 P3C.860767 Protector, LP compressor rear 1018 83 P3C.899012 Checking gauge, LP compressor 1018 210 PJ.1065974 Protector, HP compressor rear 1018 | *1651 | P3C.334809 | Handle, torque multiplier (1022) | 1003 |
| *1099 P3C.699918 Mechanical driver, LP compressor 1016 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1018 bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe 1018 ring nut *325 P3C.1073286 Spanner wrench, LP compressor 1018 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1018 *1227 P3C.860767 Protector, LP compressor rear 1018 83 P3C.899012 Checking gauge, LP compressor 1018 210 PJ.1065974 Protector, HP compressor rear 1018 | * 283 | P3C.1073105 | rear bearing | 1016 |
| *1099 P3C.699918 Mechanical driver, LP compressor 1016 bearing *1551 P3C.1212107 Wrench spanner, LP compressor 1018 bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe 1018 ring nut *325 P3C.1073286 Spanner wrench, LP compressor 1018 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1018 *1227 P3C.860767 Protector, LP compressor rear 1018 83 P3C.899012 Checking gauge, LP compressor 1018 210 PJ.1065974 Protector, HP compressor rear 1018 | 284 | P3C.1073106 | Adapter, mechanical driver (1099) | 1018 |
| bevel gear retaining nut *1330 P3C.893238 Immobilizer, LP compressor probe 101 ring nut *325 P3C.1073286 Spanner wrench, LP compressor 101 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 101 *1227 P3C.860767 Protector, LP compressor rear 101 83 P3C.899012 Checking gauge, LP compressor 101 210 PJ.1065974 Protector, HP compressor rear 101 | *1099 | P3C.699918 | | 1016 |
| *1330 P3C.893238 Immobilizer, LP compressor probe 1014 ring nut * 325 P3C.1073286 Spanner wrench, LP compressor 1015 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1015 *1227 P3C.860767 Protector, LP compressor rear 1015 83 P3C.899012 Checking gauge, LP compressor 1015 210 PJ.1065974 Protector, HP compressor rear 1015 | *1551 | P3C.1212107 | Wrench spanner, LP compressor bevel gear retaining nut | 1015 |
| * 325 P3C.1073286 Spanner wrench, LP compressor 1019 probe ring nut *1333 P3C.893963 Multiplier, spanner wrench (325) 1019 *1227 P3C.860767 Protector, LP compressor rear 1019 83 P3C.899012 Checking gauge, LP compressor 1019 210 PJ.1065974 Protector, HP compressor rear 1019 | *1330 | P3C.893238 | Immobilizer, LP compressor probe | 1014 |
| *1333 P3C.893963 Multiplier, spanner wrench (325) 101 *1227 P3C.860767 Protector, LP compressor rear 101 83 P3C.899012 Checking gauge, LP compressor 101 210 PJ.1065974 Protector, HP compressor rear 101 | *. 325 | P3C.1073286 | Spanner wrench, LP compressor | 1015 |
| *1227 P3C.860767 Protector, LP compressor rear 1013 83 P3C.899012 Checking gauge, LP compressor 1013 210 PJ.1065974 Protector, HP compressor rear 1013 | *1333 | P3C.893963 | Multiplier, spanner wrench (325) | 1015 |
| 83 P3C.899012 Checking gauge, LP compressor 101 210 PJ.1065974 Protector, HP compressor rear 101 | | | Protector, LP compressor rear | 1013 |
| 210 PJ.1065974 Protector, HP compressor rear 101 | | | | 1019 |
| * 396 P3C.1083282 Support steady, LP drive shaft 101 | 210 | PJ.1065974 | Protector, HP compressor rear | 1019 |
| | * 396 | P3C.1083282 | Support steady, LP drive shaft | 1013 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| 835 | PJ.1234541 | Alignment locking tool, LP drive shaft | 1019 |
| 838 | PJ.1244631 | Split guide, alignment locking tool (835) | 1019 |
| 836 | PJ.1244623 | Split sleeve, alignment locking tool (835) | 1019 |
| 837 | PJ.1244624 | Lifting fixture, HP drive shaft | 1019 |
| 839 | PJ.1244726 | Setting tool, spherical mounting | 1020 |
| 804 | PJ.1244629 | Spacer, LP/HP assemblies | 1020 |
| * 981 | P3C.1234443 | Lifting fixture, LP drive shaft | 1010 |
| *1200 | P3C.858985 | Packing, slave, LP compressor rear case | 1012 |
| *1201 | P3C.858986 | Packing, slave, LP compressor rear case | 1013 |
| 163 1 | - | Salter spring balance, 400 lb (181.4 kg) | 1020 |
| 803 | PJ.1244634 | Container, alignment tool (835) | 1020 |
| 1542 | P3C.1094709 | Ratchet wrench, torque, inter- mediate case | 1020 |
| *1541 | P3C.1094707 | Spanner wrench, labyrinth/ bearing housing | 1013 |
| 822 | P3C.1094708 | Ratchet wrench socket, torque | 1020 |
| 821 | P3C.1094706 | Ratchet wrench, intermediate case | 1021 |
| 995 | P3C.1234553 | Protector, LP exit guide vane location | 1021 |
| 802 | PJ.1255600 | Adapter, pressure test | 1021 |
| 1585 | P3C.1234460 | Cranked ring wrench, LP exit guide vane cases | 1021 |
| *1054 | P3C.695736 | Multiple leg sling, rear bearing adapter (1028) | 1012 |
| 1370 | P3C.1062825 | Protector, rear bearing adapter | 1021 |
| *1237 | P3C.862465 | Protector, HP compressor rear | 1008 |
| *1019 | P3C.1244800 | Mechanical puller, HP turbine inner track | 1009 |
| *1202 | P3C.858987 | Guide sleeve, HP drive shaft | 1007 |
| *1304 | P3C.871850 | Guide pin, HP compressor/ diffuser case | 1008 |
| *1058 | PJ.695743 | Split sleeve, LP drive shaft | 1006 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 1224 | PJ.899191 | Guide sleeve, retaining ring | 1021 |
| 334 | P3C.1076074 | Lifting ring, spanner (1085) | 1022 |
| 1085 | P3C.695770 | Wrench spanner, HP turbine hub | 1022 |
| 1343 | P3C.896945 | Immobilizer, torque multiplier (1022) | 1022 |
| *1315 | P3C.892955 | Adapter, torque multiplier (1022) | 1006 |
| 274 | P3C.1072982 | Peening tool, hub nut keywasher | 1022 |
| *1120 | P3C.699964 | Lifting fixture, HP turbine rotor | 1005 |
| *1354 | P3C.899008 | Immobilizer, HP turbine | 1005 |
| *1630 | P3C.898073 | Spanner wrench, HP turbine hub | 1005 |
| 82 | P3C.899009 | Checking fixture, HP turbine bolt stretch | 1022 |
| 1975 | P5J.1288024 | Hook, HP turbine nozzle vane | 1023 |
| *1061 | P3C.695746 | Protector, HP turbine rear labyrinth | 1005 |
| *1192 | P3C.858919 | Multiple leg sling, LP turbine nozzle | 1005 |
| *1013 | PJ.1255652 | Steady, LP drive shaft | 1004 |
| 1645 | T.251081 | Multiple leg sling, clamping ring (1262) | |
| 1262 | P3C.865931 | Clamping ring, LP nozzle vanes | 1023 |
| 76 | P3C.863689 | Checking gauge, LP turbine adjusting washer | 1023 |
| *1142 | P3C.850928 | Lifting/extracting fixture, LP turbine hub | 1004 |
| 1146 | P3C.850933 | Mechanical driver, LP turbine hub | 1023 |
| * 862 | PJ.1212179 | Immobilizer, LP turbine drive | 1003 |
| *1616 | PT.869300 | Wrench spanner, LP turbine bearing nut | 1003 |
| *1647 | T.279767 | Torque multiplier, spanner wrench (1616 and 1578) | 1003 |
| *1578 | PJ.1229386 | Wrench spanner, LP turbine hub | 1003 |
| * 927 | P3C.1229246 | Immobilizer, LP drive shaft | 1001 |
| | | | 1001 |
| *1261 | P3C.863691 | Centralizing fixture, LP drive shaft | 100 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| * 609 | P3C.1089117 | Split sleeve, LP locking tube | 1008 |
| *1452 | POJ.868978 | Container, locking tube | 1009 |
| *1323 | P3C.893237 | Lifting fixture, LP locking tube | 1008 |
| 611 | P3C.1089119 | Alignment tool, LP locking tube splines | 1023 |
| * 929 | P3C.1229270 | Spanner wrench, LP signal system mechanism retaining nut | 1002 |
| *1 300 | P3C.869240 | Adapter, torque multiplier (1022) | 1002 |
| 314 | P3c.1073298 | Peening tool, LP signal system keywasher | 1024 |
| * 1617 | P3c.871370 | Spanner wrench, LP locking tube locknut | 1002 |
| *1513 | P3c.1076009 | Spanner wrench, LP signal system nut | 1002 |
| *1180 | P3C.857396 | Protector, LP turbine assembly | 1004 |
| 305 | P3C.1073197 | Lifting fixture, turbine exhaust diffuser | 1024 |
| 1508 | P3c.1073170 | Ring wrench cranked, CCOC/turbine exhaust diffuser | 1024 |
| 239 | P3c.1072828 | Adapter, ring wrench (1508) | 1024 |
| 1350 | P3C.898494 | Protector, turbine exhaust diffuser vanes | 1024 |
| * 437 | P3c.1086733 | Protector, turbine exhaust diffuser | 1001 |
| 1480 | P3C_1065044 | Ring wrench, air tube | 1024 |
| 793 | P3c.1089439 | Adapter, lifting fixture (795) | 102 |
| 794 | P3C.1089440 | Adapter, lifting fixture (795) | 1.025 |
| 795 | P3C.1089441 | Lifting fixture, right-hand gearbox | 102 |
| 798 | P3C.1089447 | Lifting fixture, arm (795) | 102 |
| 1302 | P3C.869247 | Turnbuckle, lifting fixture (798) | |
| 613 | P3C.1089125 | Hand turning tool, engine | 102 |
| 3132 | PE.27426 | Wrench, swivel | 1028 |
| 419 | PJ.1294406 | Wrench, QAD coupling ring | 102 |
| 1872 | PE.22056 | Universal joint, engine turning | 102 |
| 1876 | PE.20785 | Adapter, universal joint (1872) | 1026 |
| 1873 | T2.EC.3312 | Extension bar, universal joint (1872) | 102 |
| 1874 | s3s.12619000 | Torque wrench, HP rotating assembly | 102 |

Assembly Tools
Table 1002 (Continued)

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| | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|---------|-----------------|--------------------------|--|-------------|
| | 1875 | T2.EP.1594 | Torque adapter | 1026 |
| ъ | 957 | P3C.1229382 | Mechanical puller, hollow pin | 1027 |
| and | 958 | P3C.1229383 | Mechanical puller, hollow pin | 1027 |
| Engl | 197 | P3C.1065891 | Lifting fixture, left-hand gearbox | 1027 |
| E. | 1530 | P3C.1089255 | Ring wrench cranked, left-hand gearbox bolts | 1027 |
| - | 222 | P3C.1065934 | Protector, left-hand gearbox | 1027 |
| Printed | 1877 | \$38.12620000 | Torque wrench, LP rotating assembly | 1027 |
| - | 3157 | S3S.20205000 | Immobiliser | 1028 |
| ŗ. | 3158 | s3s.20206000 | Immobiliser | 1028 |
| _ | 3159 | s3s.20207000 | Spacer sleeve | 1028 |
| | 3164 | s3s.20727000 | Spanner | 1028 |

Assembly Tools Table 1002 (Concluded)

SPECIAL TOOL ETC.

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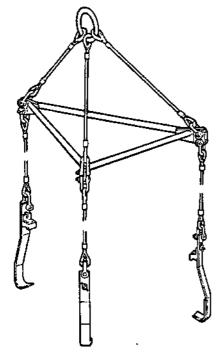
Dec 31/00



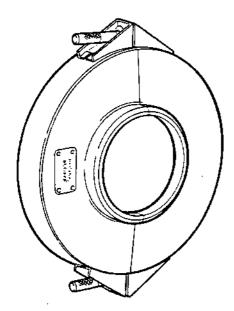
WMPUS 503 mk.610–14–28 overhaul



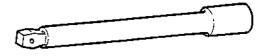
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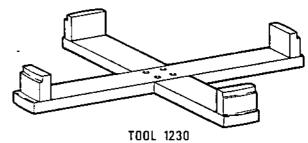
TOOL 1973 24.00 X 33.25 X 70.75 IN (610 X 845 X 1800 MM)



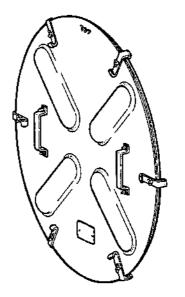
TOOL 1138 14.00 X 11.50 X 2.75 IN (360 X 295 X 70 MM)



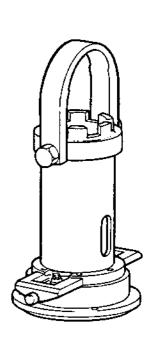
TOOL 1974 6.00 X 0.75 IN DIA (155 X 20 MM)



3.00 X 48.25 IN DIA (80 X 1230 MM)



TOOL 437 3.00 X 42.00 IN DIA (75 X 1065 MM)



TOOL 927 17.50 X 11.00 X 7.50 tN (450 X 280 X 195 MM)

Engine - Special Tools Figure 1001

SPECIAL TOOLS ETC.

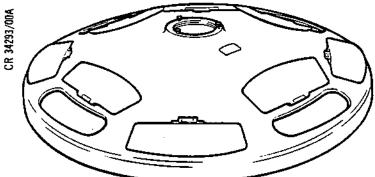
72-00-00 Page 1011 Aug 1/78

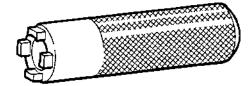


OLYMPUS 593

MK.610-14-28 OVERHAUL

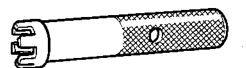




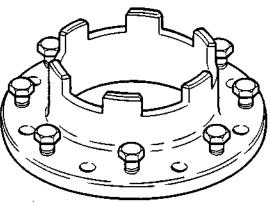


TOOL 1513 5.00 X 1.25 IN DIA (130 X 35 MM)

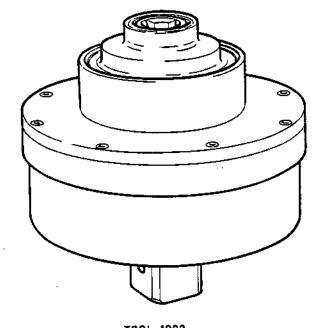
TOOL 1261 8.25 X 48.75 IN DIA (210 X 1240 MM)



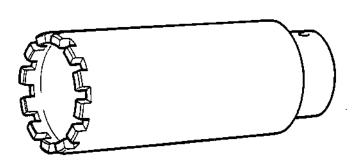
TOOL 1617 7.00 X 1.50 IN DIA (180 X 40 MM)



TOOL 1300 2.25 X 7.00 IN DIA (60 X 180 MM)



TOOL 1022 7.50 X 7.25 IN DIA (195 X 185 MM)

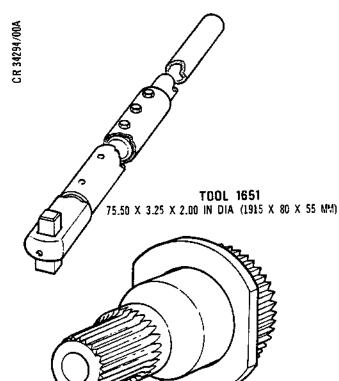


TOOL 929 10.25 X 3.75 IN DIA (260 X 100 MM)

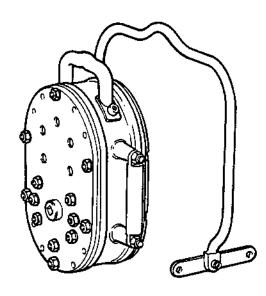
Engine - Special Tools Figure 1002

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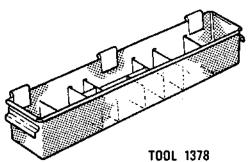




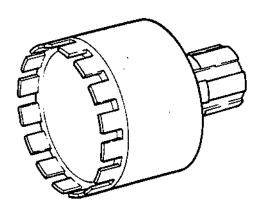
TOOL 862 5.50 X 3.25 IN (140 X 85 MM)



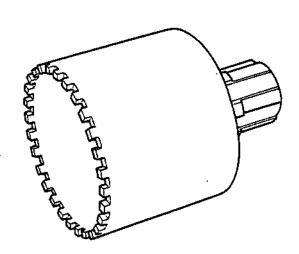
TOOL 1647 14.50 X 14.50 X 6.50 IN DIA (380 X 380 X 170 MM)



26.25 X 5.00 X 4.25 IN (670 X 125 X 110 MM).



TOOL 1578 6.75 X 5.25 IN DIA (175 X 135 MM)



TOOL 16167.50 X 5.50 IN DIA (195 X 140 MM)

SPECIAL TOOLS ETC.

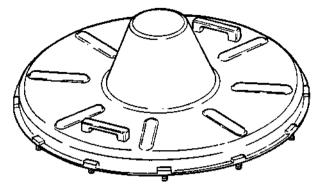
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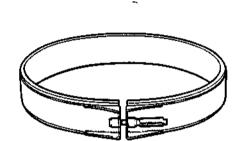
MK.610-14-28
OVERHAUL



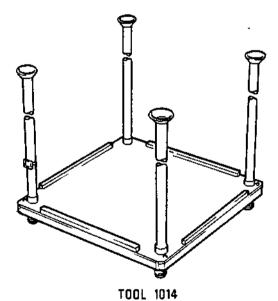
CR 34295/00A



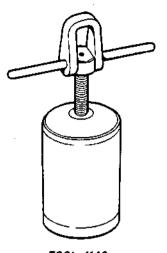
TOOL 1180 14.00 X 48.00 IN DIA (355 X 1220 MM)



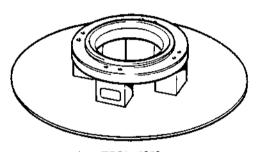
TOOL 1134 13.75 X 2.25 X 13.00 IN DIA (350 X 330 X 60 MM)



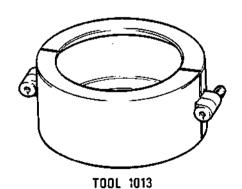
46.00 X 46.00 IN (1170 X 1170 MM) (HEIGHT AS REQUIRED)



TOOL 1142 11.00 X 16.75 IN (280 X 425 MM)



TOOL 1012 4.50 X 22.00 IN DIA (115 X 560 MM)



3.50 X 7.75 IN DIA (90 X 200 MM)

Engine - Special Tools Figure 1004

SPECIAL TOOLS ETC.

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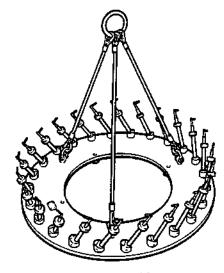


01YMPUS 598

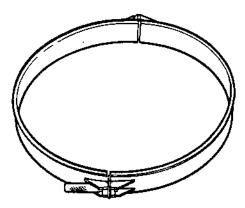
MK.610-14-28 OVERHAUL



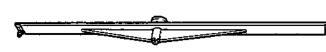




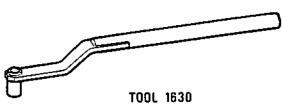
TOOL 1192 40.00 X 37.00 IN DIA (1020 X 940 MM)



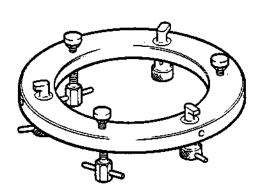
TOOL 1061 2.25 X 19.00 IN DIA (55 X 480 MM)



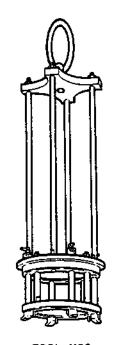
TOOL 1354 47.25 IN X 3.75 X 2.00 IN (1200 X 95 X 50 MM)



26.25 X 1.25 IN DIA (700 X 35 MM)



TOOL 1247
3.25 X 10.00 IN DIA (85 X 255 MM)



TOOL 1120 28.25 X 7.50 IN DIA (715 X 190 MM)

Engine - Special Tools Figure 1005

SPECIAL TOOLS ETC.

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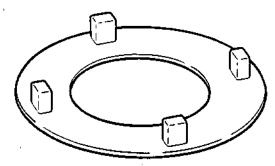


OLYMPUS 598

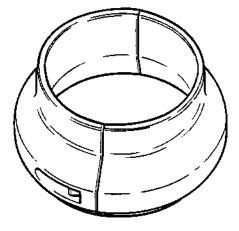
MK.610-14-28 OVERHAUL



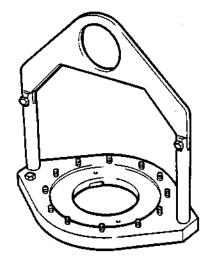




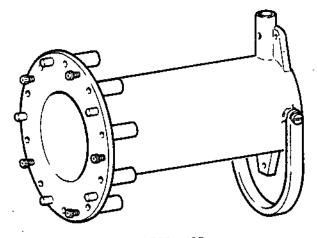
TOOL 979 2.75 X 24.00 IN DIA (70 X 610 MM)



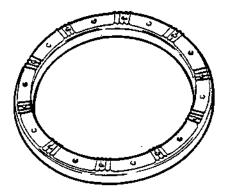
TOOL 1058 3.00 X 6.25 IN DIA (80 X 160 MM)



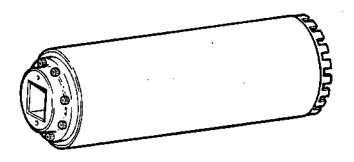
TOOL 106 14.25 X 15.00 IN DIA (365 X 385 MM)



TOOL 105 16.75 X 22.00 IN DIA (425 X 560 MM)



TOOL 1315 1.25 X 14.75 IN DIA (35 X 75 MM)



TOOL 107 23.00 X 7.75 IN DIA (585 X 200 MM)

Engine - Special Tools Figure 1006

SPECIAL TOOLS ETC.

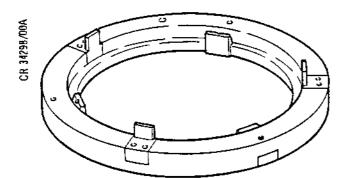
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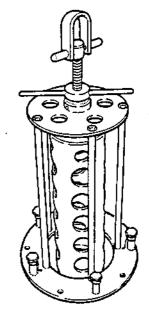
0LYMPUS 593

MK.610-14-28 OVERHAUL

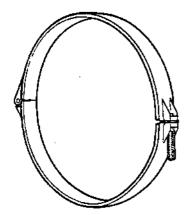




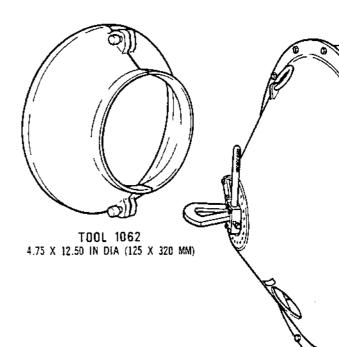
TOOL 1297 1.75 X 8.75 IN DIA (45 X 225 MM)



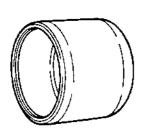
TOOL 1057 40.50 X 14.75 IN DIA (1030 X 380 MM)



TOOL 1063 1.75 X 19.75 IN DIA (45 X 500 MM)



TOOL 1310 22.00 X 43.50 IN DIA (560 X 1105 MM)



TOOL 1202 6.25 X 7.25 IN DIA (160 X 185 MM)

Engine - Special Tools Figure 1007

SPECIAL TOOLS ETC.

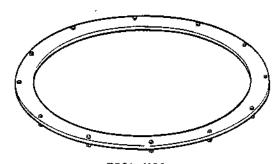
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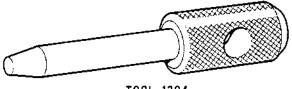
NWMPUS 598 mk.610-14-28 overhaul



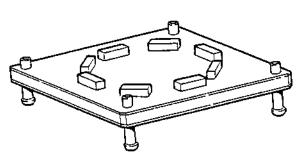
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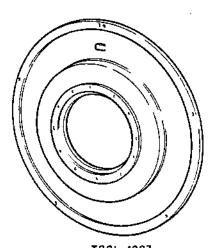
TOOL 1183 1.75 X 48.00 IN DIA (45 X 1220 MM)



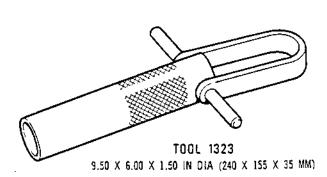
TOOL 1304 2.75 X 0.50 IN DIA (70 X 15 MM)

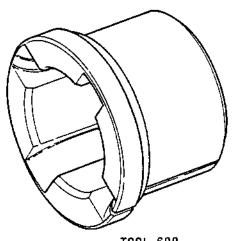


TOOL 1661 46.00 X 46.00 X 8.50 IN DIA (1170 X 1170 X 220 MM)



TOOL 1237 2.25 x 34.25 in dia (60 x 870 mm)





TOOL 609 2.25 X 3.25 IN DIA (55 X 80 MM)

Engine - Special Tools Figure 1008

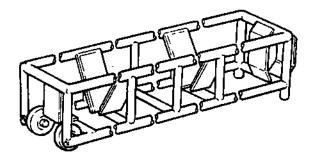
72-00-00

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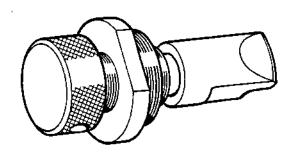




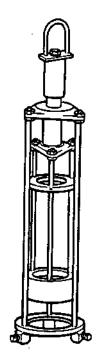
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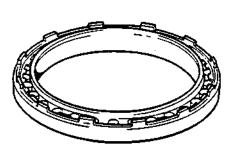
TOOL 1452 92.75 X 6.00 X 4.75 IN (2360 X 155 X 125 MM)



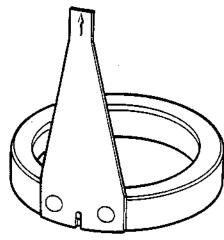
TOOL 1979 2.75 X 1.25 IN DIA (70 X 35 MM)



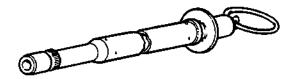
TOOL 1019 48.25 X 12.25 IN DIA (1230 X 315 MM)



TOOL 248 1.50 X 8.75 IN DIA (40 X 225 MM)



TOOL 973 5.75 X 5.25 X 5.00 IN DIA (150 X 130 X 130 MM)



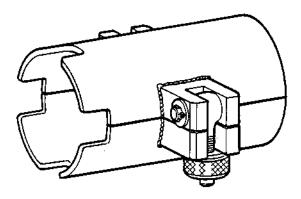
TOOL 579 94.25 X 4.75 X 3.50 IN DIA (2390 X 125 X 90 MM)

Engine - Special Tools Figure 1009

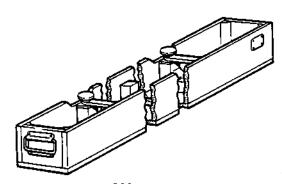
SPECIAL TOOLS ETC.

72-00-00

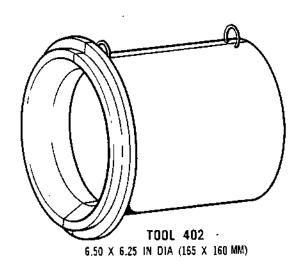
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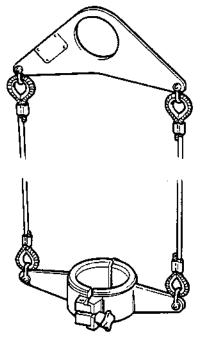


TDOL 980 4.25 X 4.00 X 2.25 IN DIA (105 X 100 X 60 MM)

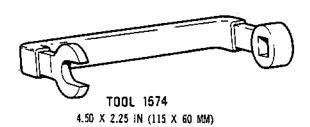


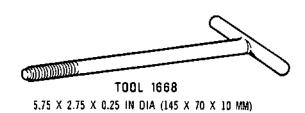
TOOL 580 99.25 X 6.25 X 5.50 IN (2520 X 160 X 140 MM)





TOOL 981 31,00 X 16.00 X 5.00 IN (790 X 410 X 130 MM)





Engine - Special Tools Figure 1010

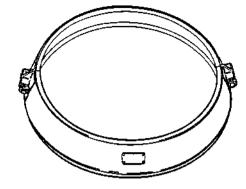
SPECIAL TOOLS ETC. Page 1020 Aug 1/78



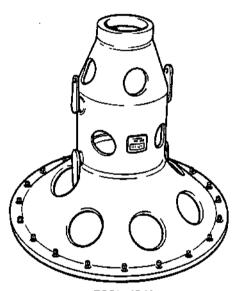
OVERHAUL



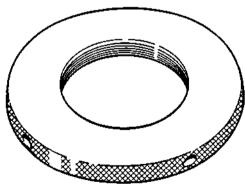
CR 34302/00A



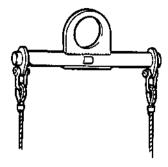
TOOL 1239 24.50 X 4.00 IN (620 X 105 MM)



TOOL 1041 32.00 X 36.00 IN DIA (810 X 915 MM)

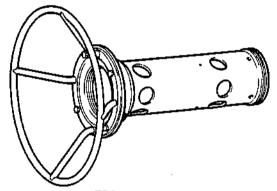


TOOL 1042 0.50 x 6.00 IN DIA (15 X 155 MM)

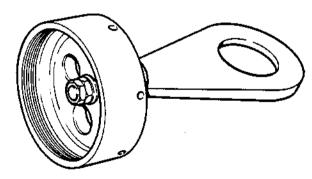




37.75 X 17.75 IN (960 X 450 MM)



TOOL 391 25.50 X 20.00 IN DIA (650 X 510 MM)



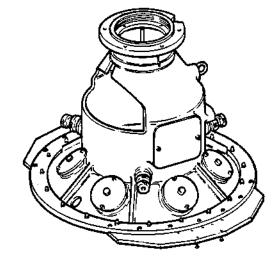
TOOL 1043 15.25 X 7.25 IN DIA (385 X 185 MM)

Engine - Special Tools Figure 1011

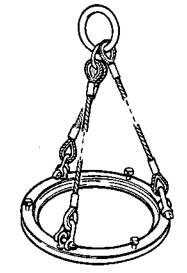
72-00-00

OVERHAUL

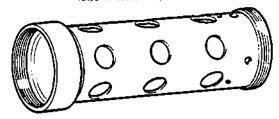




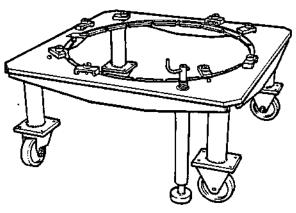
TOOL 1028 43.00 X 31.00 IN (1095 X 785 MM)



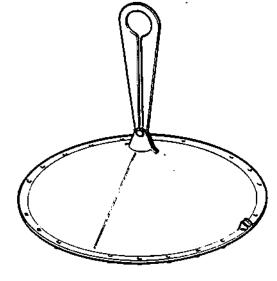
TOOL 1054 43.00 X 13.75 IN DIA (1095 X 350 MM)



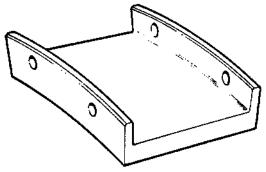
TOOL 389 19.50 X 7.00 IN DIA (495 X 180 MM)



TOOL 1036 42.00 X 42.00 X 23.50 IN (1070 X 1070 X 600 MM)



TOOL 1039 38.75 X 36.00 IN DIA (985 X 915 MM)



TOOL 1200 5.00 X 3.75 X 1.00 IN (125 X 95 X 30 MM)

Engine - Special Tools Figure 1012

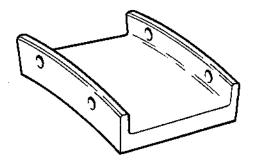
SPECIAL TOOLS ETC.

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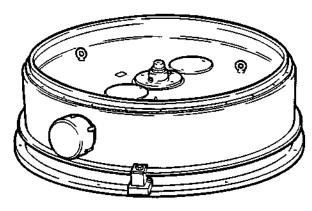
TN41533



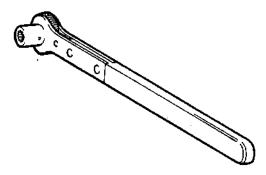




TOOL 1201 5.00 X 3.75 X 1.00 IN (130 X 95 X 30 MM)



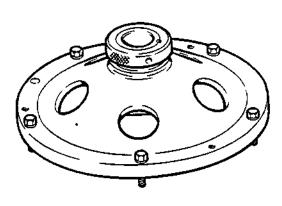
TOOL 1244 15.75 X 54.50 IN DIA (400 X 1385 MM)



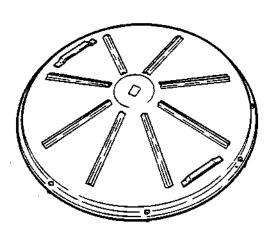
TOOL 1569 11.50 X 1.25 X 1.25 IN (295 X 30 X 30 MM)



TOOL 1541 17.75 X 1.25 X 0.75 IN (450 X 30 X 20 MM)



TOOL 396 5.00 X 12.50 IN DIA (130 X 315 MM)



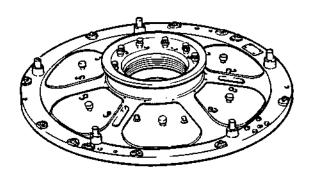
TOOL 1227 9.00 X 36.75 IN DIA (230 X 930 MM)

SPECIAL TOOLS ETC.

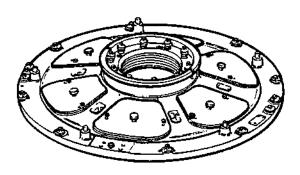
72-00-00

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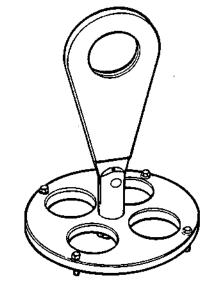




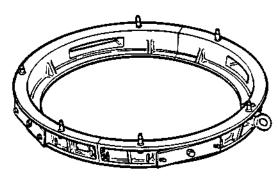
TOOL 1011 6.50 X 36.50 IN DIA (165 X 930 MM)



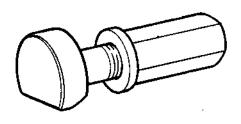
TOOL 344 6.50 X 36.50 IN DIA (165 X 930 MM)



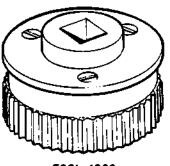
TOOL 1096 15.50 X 10.75 IN DIA (395 X 270 MM)



TOOL 398 39.50 X 5.50 X 38.75 IN DIA (1005 X 140 X 985 MM)



TOOL 559 2.00 X 0.75 IN DIA (55 X 20 MM)



TOOL 1330 2.75 X 4.75 IN DIA (70 X 120 MM)

SPECIAL TOOLS ETC.

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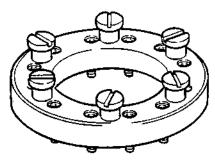


OLYMPUS 598

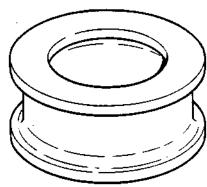
OVERHAUL

SNECH

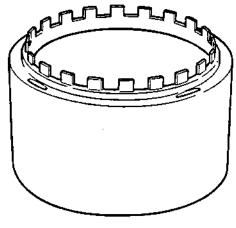
CR 34306/00A



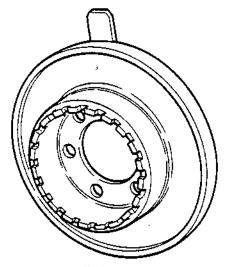
TOOL 1333 1.50 X 4.75 IN DIA (40 X 125 MM)



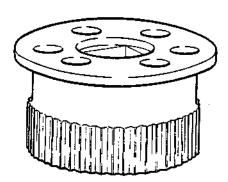
TOOL 696 I.75 X 4.25 IN DIA (45 X 110 MM)



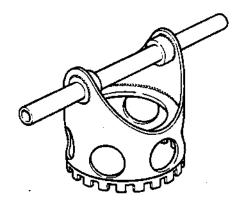
TOOL 1594 4.75 X 7.50 IN DIA (120 X 195 MM)



TOOL 325 10.75 X 3.00 X 9.25 IN DIA (270 X 75 X 230 MM)



TOOL 280 2.75 X 5.00 IN DIA (70 X 130 MM)

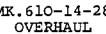


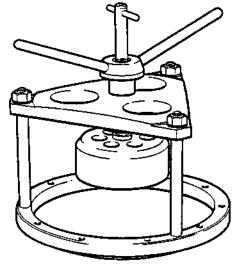
TOOL 1551 15.00 X 7.00 IN (380 X 180 MM)

Engine - Special Tools Figure 1015

SPECIAL TOOLS ETC.

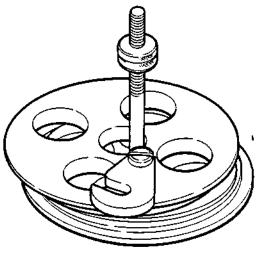
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TOOL 283

14.00 X 13.00 X 13.00 IN (360 X 335 X 335 MM)

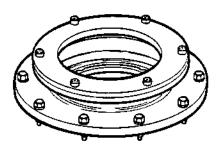


TOOL 1198

5.00 X 6.00 IN DIA (130 X 155 MM)

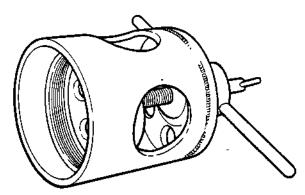


TOOL 345 0.50 X 6.50 IN DIA (15 X 165 MM)



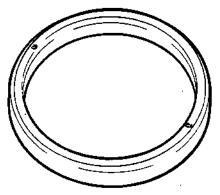
TOOL 346

3.25 X 12.50 IN DIA (85 X 320 MM)



TOOL 1099

12.50 X 11.25 X 6.00 IN DIA (320 X 285 X 155 MM)

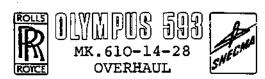


TOOL 1100

0.75 X 6.50 IN DIA (20 X 165 MM)

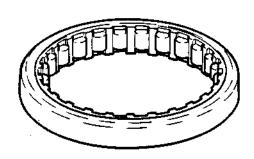
Engine - Special Tools Figure 1016

SPECIAL TOOLS ETC.

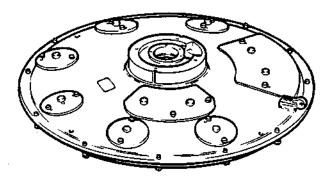




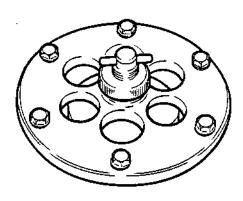
TOOL 1658 29.00 X 4.50 X 3.00 IN (740 X 105 X 80 MM)



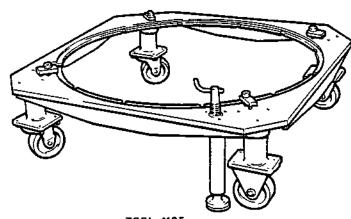
TOOL 1288 0.75 X 5.25 IN DIA (20 X 135 MM)



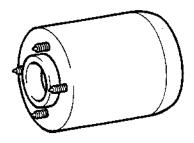
TOOL 588 8.00 X 49.00 IN DIA (200 X 1245 MM)



TOOL 1106 3.25 X 6.50 IN DIA (80 X 170 MM)



TOOL 1105 50.50 X 50.50 X 20.50 IN (1285 X 1285 X 520 MM)



TOOL 319 5.25 X 4.25 IN DIA (105 X 110 MM)

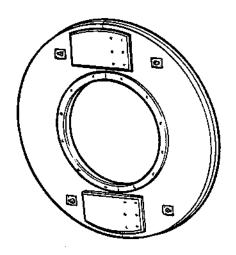
SPECIAL TOOLS ETC.

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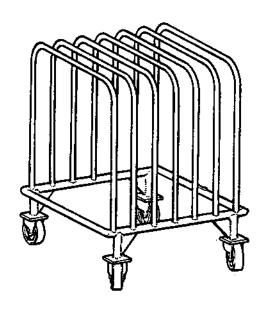
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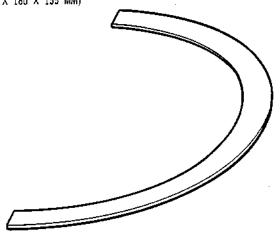


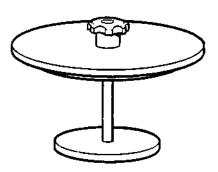


TOOL 1308 2.50 X 96.00 IN OIA (65 X 2440 MM)

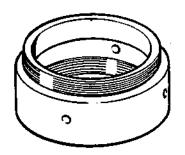


TOOL 85 33.25 X 29.00 X 24.00 IN (845 X 740 X 610 MM)





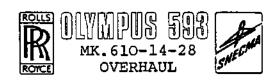
TOOL 1369 4.50 X 9.75 IN DIA (115 X 250 MM)

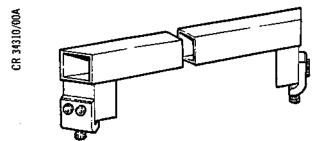


TOOL 284 2.50 X 5.50 IN DIA (65 X 140 MM)

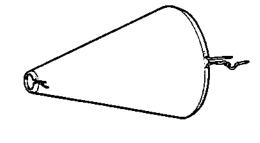
SPECIAL TOOLS ETC.

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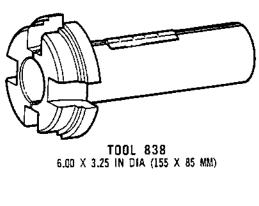
TOOL 83 31.50 X 4.00 X 1.50 IN (805 X 105 X 35 MM)

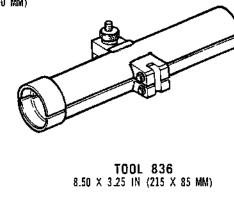


TOOL 210 57.00 X 44.00 IN DIA (1550 X 1120 MM)



*TOOL 835 109.75 X 6.25 IN (2785 X 160 MM)





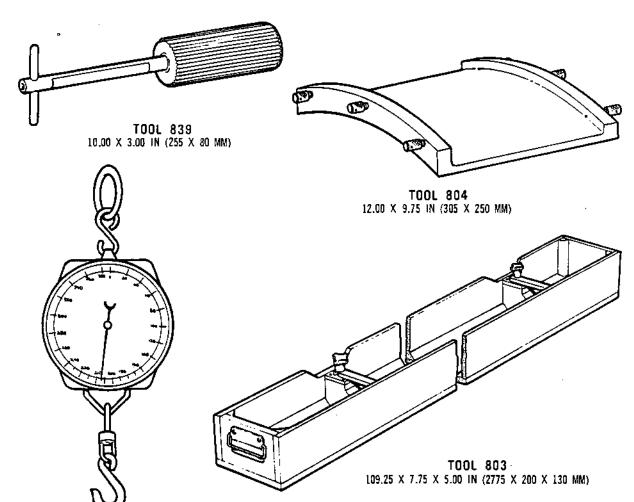
TOOL 837 51.50 X 19.25 IN (1315 X 500 MM)

Engine - Special Tools Figure 1019

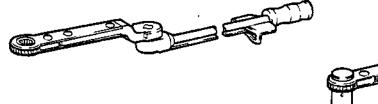
72-00-00

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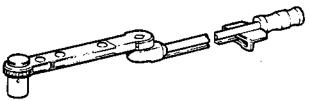




TOOL 1631 26.00 X 11.00 X 2.50 IN (660 X 280 X 65 MM)



TOOL 1542 16.00 X 1.25 X 1.00 1N (410 X 35 X 30 MM)



TOOL 822 16.00 X 1.50 X 1.00 IN (410 X 40 X 30 MM)

SPECIAL TOOLS ETC.

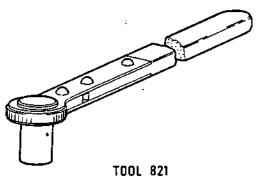
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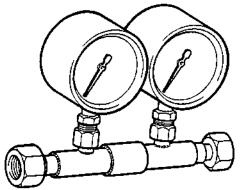




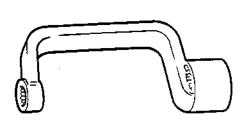
11.75 X 1.00 X 1.00 IN (300 X 25 X 25 MM)



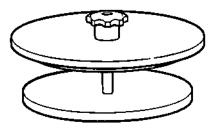
TOOL 995 6.75 X 6.00 IN DIA (STOWED) (170 X 155 MM)



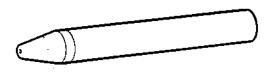
TOOL 802 6.25 X 4.25 IN (160 X 110 MM)



TOOL 1585 3.00 X 1.50 X 1.00 IN (75 X 40 X 25 MM)



TOOL 1370 4.75 X 10.00 IN DIA (125 X 255 MM)

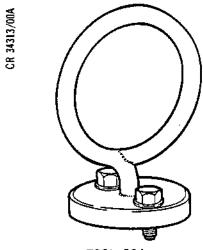


TOOL 1224 5.50 X 0.75 IN DIA (140 X 20 MM)

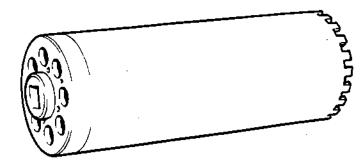
Engine - Special Tools Figure 1021

SPECIAL TOOLS ETC.

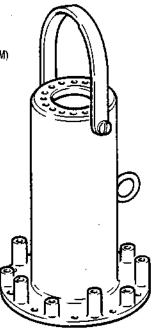




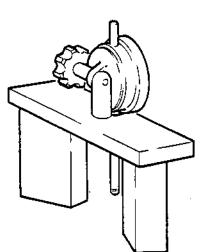
TOOL 334 6.00 x 4.25 x 3.00 IN DIA (155 X 110 X 80 MM)



TOOL 1085 22.75 X 7.75 IN DIA (580 X 195 MM)



TOOL 1343 21.00 X 14.75 X 15.50 IN DIA (535 X 375 X 395 MM)



TOOL 82 7.75 X 6.50 X 2.00 IN (200 X 170 X 55 MM)

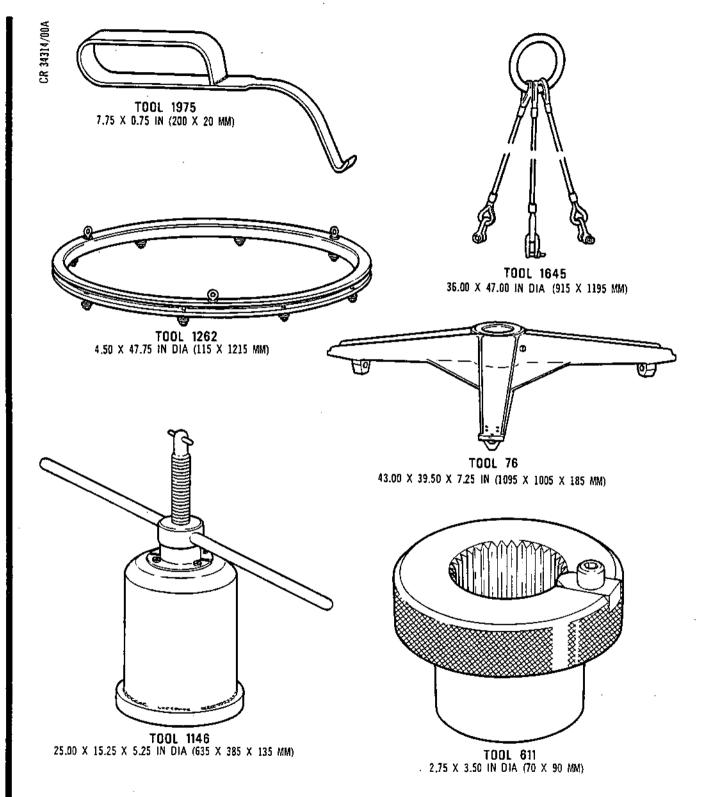


TOOL 274 12.00 X 0.75 IN DIA (305 X 20 MM)

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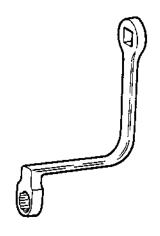




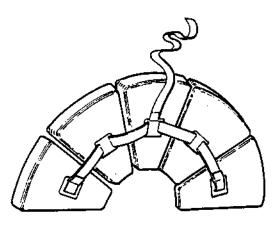
SPECIAL TOOLS ETC.

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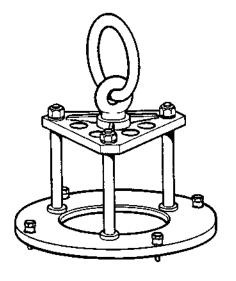
TOOL 31412.25 X 4.25 X 1.00 IN (315 X 110 X 25 MM)



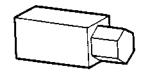
TOOL 1508 4.25 X 2.75 IN (110 X 70 MM)



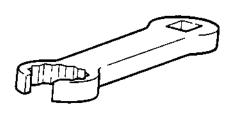
TOOL 1350 40.50 X 20.25 X 2.00 IN (1030 X 515 X 55 MM)



TOOL 305 14.25 X 12.25 IN DIA (360 X 310 MM)



TOOL 239 1.50 X 0.50 X 0.50 IN (40 X 15 X 15 MM)



TOOL 1480 3.50 X 1.00 X 0.25 IN (90 X 25 X 10 MM)

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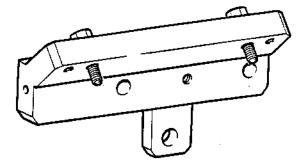


OLYMPUS 593

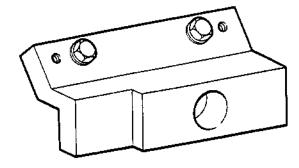
MK.610-14-2 OVERHAUL



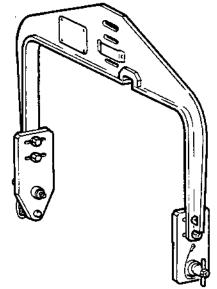




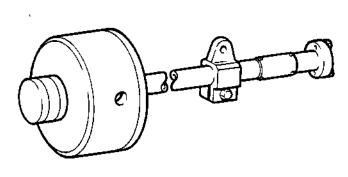
TOOL 793 $^{\circ}$ 7.50 x 4.50 x 2.75 IN (195 x 115 X 70 MM)



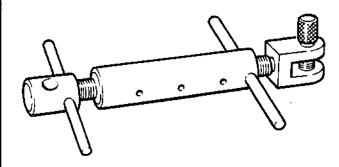
TOOL 794 6.00 x 3.25 x 2.75 IN (155 x 85 x 70 MM)



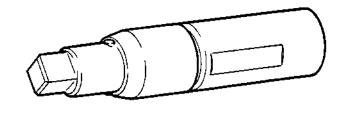
TOOL 795 33.00 X 24.00 X 3.50 IN (835 X 610 X 90 MM)



TOOL 798 72.00 X 8.75 IN DIA (1830 X 225 MM)



TOOL 1302 11.00 X 6.50 X 2.25 IN (280 X 165 X 60 MM)



TOOL 613 5.25 X 1.00 IN DIA (135 X 25 MM)

Engine - Special Tools Figure 1025

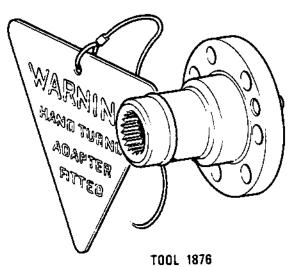
72-00-00

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TOOL 419 9.25 X 4.00 IN (235 X 100 MM)





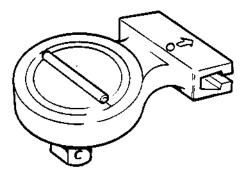
5.25 X 5.25 IN DIA (125 X 125 MM)



TOOL 1873 5.00 X 1.00 IN DIA (130 X 25 MM)



TOOL 1874 16.00 X 1.75 IN DIA (410 X 45 MM)

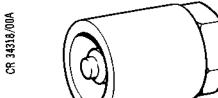


TOOL 1875 3.00 X 1.75 IN DIA (80 X 45 MM)

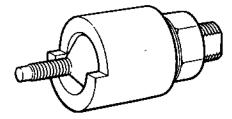
SPECIAL TOOLS ETC. Page 1036 Aug 1/78



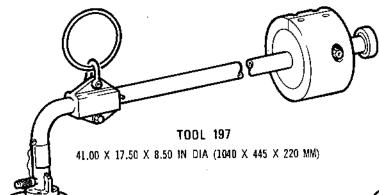


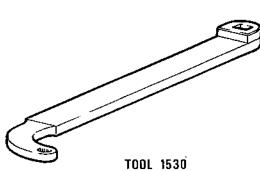


TOOL 957 1.25 X 0.75 IN DIA (35 X 20 MM)

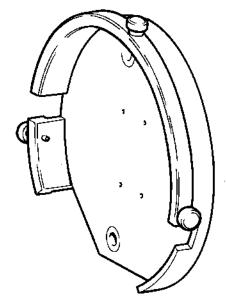


TOOL 958 1.75 X 0.75 IN DIA (45 X 20 MM)

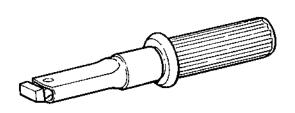




9.75 X 1.75 X 0.50 IN (250 X 45 X 15 MM)



TOOL 222 1.25 X 8.25 IN (35 X 210 MM)

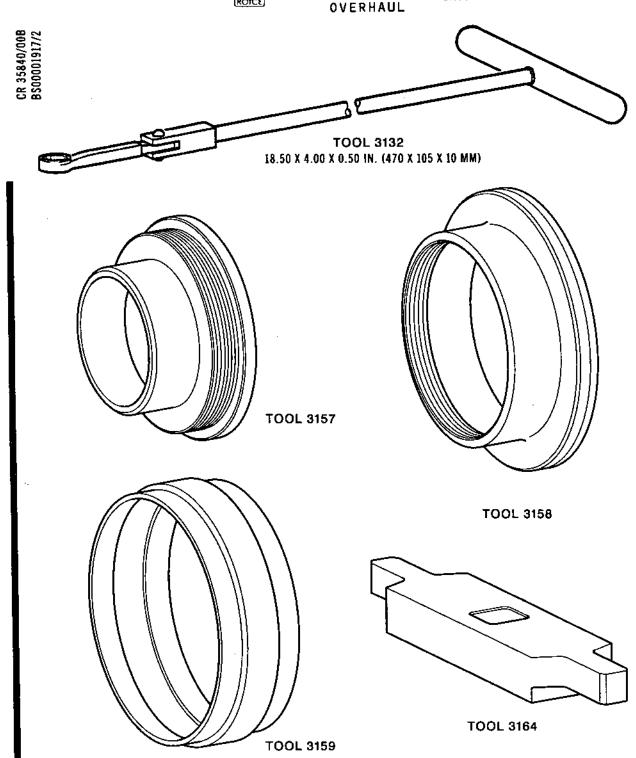


TOOL 1877 8.75 X 1.75 IN DIA (225 X 45 MM)

SPECIAL TOOLS ETC.

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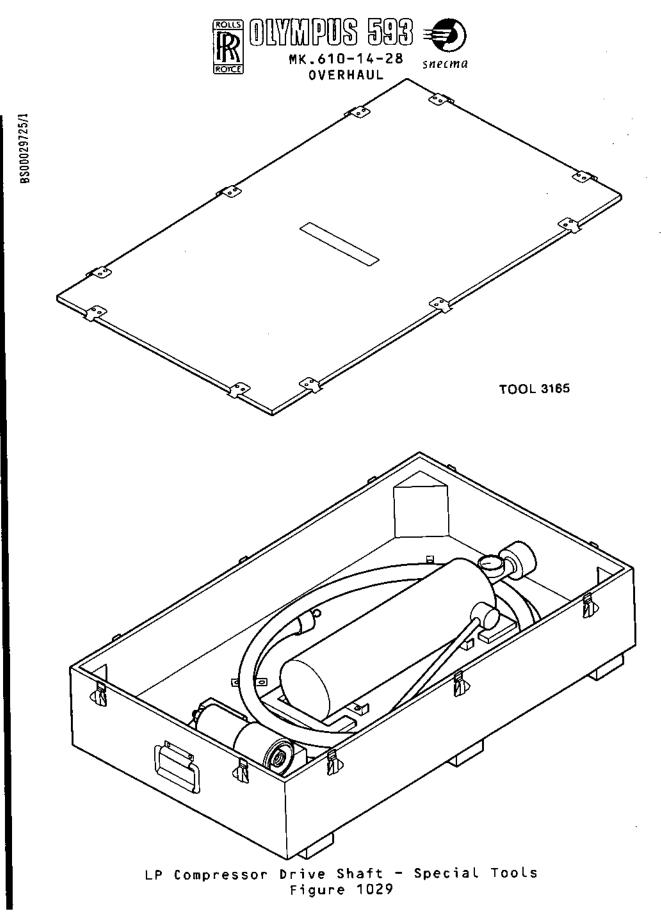




Engine - Special Tools Figure 1028

SPECIAL TOOL ETC.

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SPECIAL TOOL ETC.

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SPECIAL TOOLS ETC.

7**2-00-00** Page 1040 Dec 31/00

ENGINE TESTING - EQUIPMENT AND SET-UP - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

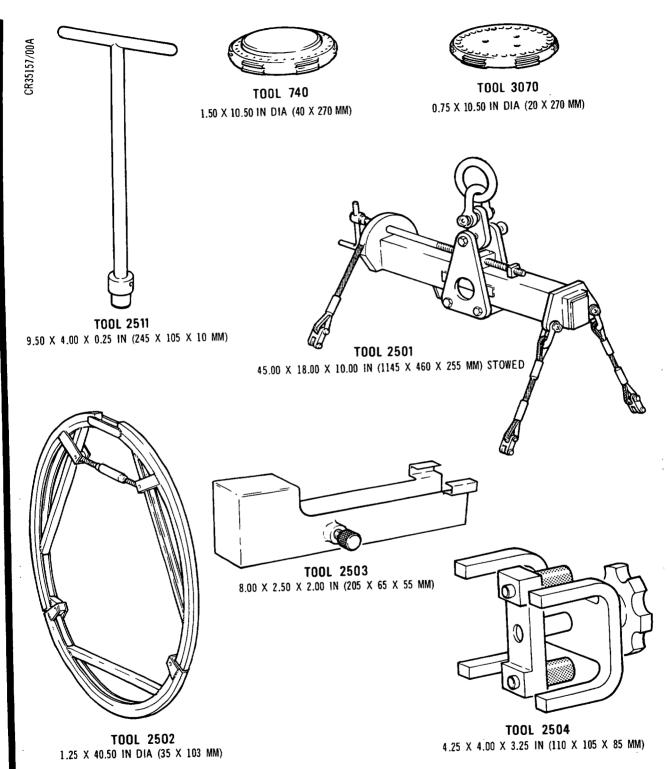
- A. The special tools, fixtures and equipment listed in Table 1001 are those required for engine test set-up.
- B. The tools are listed in their order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of testing. Tools used other than those supplied by Rolls-Royce Limited are indicated by the component manufacturer and part number.
- C. The tools have been illustrated in order of usage, but tools listed in more than one aspect of testing will be illustrated once only. Additional illustrations of tooling in operation are included in the text for clarification of usage.

2. Engine Testing Set-up Tools

| TOOL | MANUFACTURER | | FIG. |
|--------------|--------------------|---|------|
| REF.NO. | PART NO. | DESCRIPTION | NO. |
| 3170 | s3s.20239000 | Fuel Pressure (Transducer), Adaptor Assy | 1002 |
| 2511 | P5T.1294406 | Spanner, QAD clamp | 1001 |
| 740 | s3s.10700000 or | Test blank, IDG location on right-hand gearbox | 1001 |
| | P3C.1089329 | | |
| 3070 | B.488388 | Blank cover, IDG location on right-hand gearbox | 1001 |
| *2501 | LG.10976 | Sling, beam type, engine | 1001 |
| *2502 | SNECMA SC.118 | Resizing tool (852-630-100-0) | 1001 |
| *2503 | SNECMA SC.19 | Protector (9970-541-032) | 1001 |
| *2504 | SNECMA SC.10 | Extractor (852-500-127-0) | 1001 |
| | | | |

Test Tools Table 1001





Engine Testing - Special Tools Figure 1001

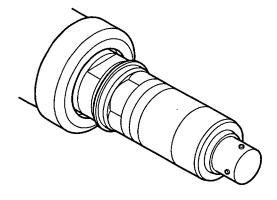
72-00-25

Page 1002 Sep 1/80



snecma

BS00032555/1



TOOL 3170

Engine Testing - Special Tools Figure 1002

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ENGINE TESTING - PROCEDURES AND ADJUSTMENTS - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

General

- A. The special tools, fixtures and equipment listed in Table 1001 are those required for engine testing procedures and adjustments.
- B. The tools are listed in their order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of testing. Tools used other than those supplied by Rolls-Royce Limited are indicated by the component manufacturer and part number.
- C. The tools have been illustrated in order of usage, but tools listed in more than one aspect of testing will be illustrated once only. Additional illustrations of tooling in operation are included in the text for clarification of usage.

2. Procedures and Adjustment Tools

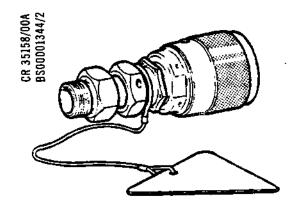
| TOOL | MANUFACTURER | | FIG. |
|---------------|-------------------------|---|------|
| REF.NO. | PART NO. | DESCRIPTION | NO |
| 2505 | PE.27795 or PE.27797 | Hose, adapter | 1001 |
| 2506 | PE.35782 | Syringe, engine servicing | 1001 |
| 2507 | PE.35783 | Extension, hose, syringe | 1001 |
| 2508 | PE.22898 | Tube, air bleed | 1001 |
| * 2509 | PE.24277 | Tool, datum resetting, Lucas T.477272 | 1001 |
| 2510 | PE.29023 | Tube, drain oil system (Pre.SB.OL.593-72-9036-419 standard) | 1001 |
| 3153 | \$3\$20590000 | Tube, drain oil system (SB.OL.593-72-9036-419 standard) | 1001 |

Test Tools Table 1001

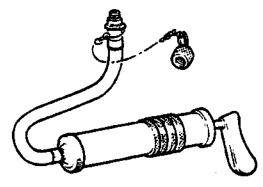


IK.61U-14-28 OVERHAUL

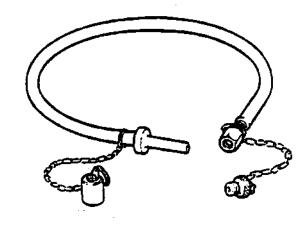




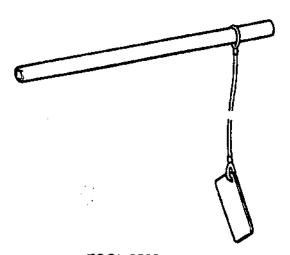
TOOL 2505 8.00 x 2.75 fm (205 x 70 MM)



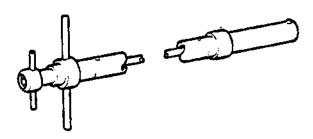
TOOL 2506 18.00 X 5.00 X 2.50 IN (460 X 130 X 65 MM) STOWED



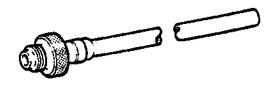
TOOL 2507 8,00 X 1.00 IN (205 X 30 MM)



TOOL 2508 7.50 X 0.50 IN DIA (190 X 15 MM)



TOOL 2509 18.50 X 5.25 X 1.25 IN DIA (470 X 135 X 35 MM)



TOOL 2510 AND TOOL 3153 73.00 x 1.25 IN DIA (1855 X 35 MM)

Engine Testing - Special Tools Figure 1001

SPECIAL TOOLS

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ENGINE TESTING - SCHEDULE AND CHECKS - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

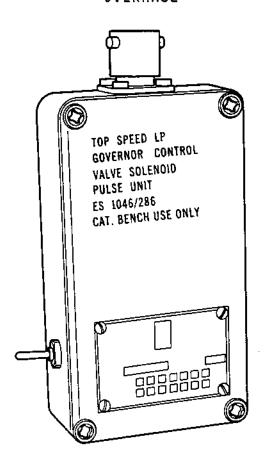
1. General

- A. The special tools, fixtures and equipment listed in Table 1001 are those required for engine testing schedule and checks.
- B. The tools are listed in their order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of testing. Tools used other than those supplied by Rolls-Royce Limited are indicated by the component manufacturer and part number.
- C. The tools have been illustrated in order of usage, but tools listed in more than one aspect of testing will be illustrated once only. Additional illustrations of tooling in operation are included in the text for clarification of usage.

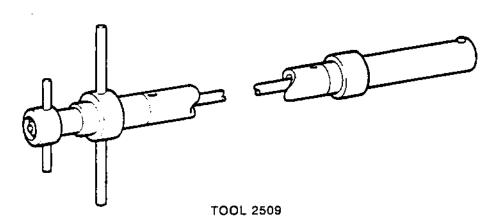
2. Schedule and Check_Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | | | | | |
|-----------------|--------------------------|--|------|--|--|--|
| *2509 | Lucas T.477272 | Tool, datum resetting | 1001 | | | |
| 3148 | ES.1046/286 | Pulse unit, top speed LP governor control valve solenoid | 1001 | | | |

Test Tools Table 1001 CR 35159/00A BS00001345/2



TOOL 3148



18.50 X 5.25 X 1.25 IN DIA (470 X 135 X 35 MM)

Engine Testing - Special Tools Figure 1001

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TURBINE STATIC - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the turbine static sub-assembly.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. Pictorial views of the tools are illustrated and reference to the relevant Fig.No. is included in the tables.

2. Turbine Static Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|------------------------------|---|------|
| *1310 | PJ.892661 or S3S.10388000 | Lifting fixture, turbine static sub-assembly | 1001 |
| *1183 | PJ.858915 | Adapter, lifting fixture (1310) Stand, turbine static sub- assembly | 1001 |
| 1649 | T.313074 | | 1001 |
| 1157 | PJ.850962 | Adapter, stand (1649) Puller, transfer tube and fuel sprayer | 1001 |
| 416 | PJ.1229339 | | 1001 |
| 1429 | PO.1255627 | Tray, fuel sprayers | 1002 |
| *1533 | P3C.1094702 | Wrench spanner, oil feed tube | 1002 |
| *1540 | P3C.1094703 | Wrench spanner, oil scavenge | 1002 |
| *1583 | P3C.1234427 | tube Cranked spanner, air duct No.5 vane | 1002 |
| 137 | T.914825 | Puller, retaining plate and housing | 1002 |
| 1415 | POJ.868928 | Container, labyrinth housing | 1002 |
| 1653 | P3C.473505 | Impact puller, nozzle vane pins | 1003 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.



| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 859 | PJ.1212165 | Adapter, impact puller (1653) | 1003 |
| *1190 | PJ.858916 | Multiple leg sling, CCOC | 1003 |
| *1645 | T.251081 | Multiple leg sling, sling (1155) | 1003 |
| *1155 | PJ.850943 | Multiple leg sling, HP nozzle vanes support cone | 1003 |
| *1014 | P3C.690045 | Pallet, nozzle/combustion chamber | 1003 |
| *1945 | P5H.1294598 | Protector, combustion chamber | 1011 |
| *3131 | S3S.15951000 | Protector, combustion chamber | 1013 |
| *1556 | PT.1223028 | Cranked ring wrench, HP nozzle vanes support cone | 1004 |
| *1372 | POJ.1077502 | Container, HP turbine nozzle vanes | 1004 |
| 1416 | POJ.868929 | Container, labyrinth seal | 1004 |
| *1552 | PT.1212130 | Cranked spanner, oil feed tube | 1004 |
| *1546 | PT.1094817 | Cranked spanner, oil scavenge tube | 1004 |
| *1181 | PJ.857941 | Wrench spanner, flexible drain tube | 1004 |
| *1545 | PT.1094816 | Cranked spanner, vent tube | 1005 |
| *1598 | PT.850941 | Cranked spanner, oil tubes | 1005 |
| * 968 | PJ.1234422 | Vice holder, drain tube | 100 |
| * 841 | PJ.1094822 | <pre>Immobiliser (left-hand) bearing housing nuts</pre> | 1009 |
| * 842 | PJ.1094823 | Immobiliser (right-hand) bearing housing nuts | 1005 |
| 1961 | S3S12129000 | Support, bearing housing | 1005 |
| 641 | РЈ.1089188 | Mechanical puller, bearing housing | 1006 |
| * 587 | PJ.1089075 | Mechanical puller, oil jet | 1006 |
| *1191 | PJ.858917 | Multiple leg sling, diffuser case | 1006 |
| *1626 | PT.894618 | Screwdriver, labyrinth seal shoulder bolts | 1006 |
| 1982 | PJ.1073084 | Pliers, roller bearings | 1006 |

Disassembly Tools Table 1001 (Concluded)

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3. Turbine Static Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 1160 | P3C.857310 | Assembly stand, compressor diffuser case | 1007 |
| 99 | PJ.858922 | Mounting plate, assembly stand (1160) | 1007 |
| *1191 | P3C.858917 | Multiple leg sling, compressor diffuser case | 1006 |
| *1626 | P3C.894618 | Screwdriver, labyrinth seal shoulder bolts | 1006 |
| 95 | P3C.1050165 | Support stand, bearing support | 1001 |
| 1663 | P3C.528493 | Sleeve, retaining ring | 100 |
| * 841 | P3C.1094822 | Immobilizer (left-hand) bearing housing nuts | 100 |
| * 842 | P3C.1094823 | <pre>Immobilizer (right-hand) bearing housing nuts</pre> | 100 |
| 1321 | P3C.893232 | Guide sleeve, retaining ring | 100 |
| * 968 | P3C.1234422 | Vice holder, drain tube | 100 |
| *1181 | P3C.857941 | Wrench spanner, flexible drain tube | 100 |
| *1598 | P3C.850941 | Cranked spanner, oil tubes | 100. |
| 694 | P5J.1266527 | Wrench spanner, oil feed tube | 100 |
| 695 | P5J.1266528 | Adapter, wrench (694) | 100 |
| 100 | PJ.858925 | Lifting support, radial setting, labyrinth seal | 100 |
| 101 | PJ.857303 | Spacing ring, radial setting, labyrinth seal | 100 |
| 1188 | PJ.857308 | Container, radial checking equipment (101, 102, 104 and 1187) | 100 |
| 102 | PJ.1234485 | Support bars, radial setting, labyrinth seal | 100 |
| 1573 | T.314708 | Lifting sling, concentricity column (103) | 100 |
| 103 | PJ.857302 | Concentricity column, radial setting, labyrinth seal | 100 |
| 1189 | PJ.857309 | Container, concentricity column | 100 |
| | | | |

Assembly Tools Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| *1645 | T.251081 | Multiple leg sling, locating cone (1186) | 1003 |
| 1186 | PJ.1212291 | Locating cone, radial setting, labyrinth seal | 1009 |
| 104 | PJ.892831 | Clamp attachment, radial setting, labyrinth seal Container, clamp attachment | 1009 |
| 1187 | PJ.857305 | Clock adapter, radial setting labyrinth seal | 1009 |
| 585 | P3C.1089073 | Guide plate, oil jet | 1009 |
| 586 | P3C.1089074 | Pin, oil jet (585) | 1009 |
| *1552 | P3C.1212130 | Cranked spanner, oil feed tube | 1003 |
| *1546 | P3C.1094817 | Cranked spanner, oil scavenge tube | 1004 |
| 3127 | S3S.15646000 | Tensioning tool | 1013 |
| *1545 | P3C.1094816 | Cranked spanner, vent tube | 1009 |
| *1583 | P3C.1234427 | Cranked spanner air duct No.5 | 1002 |
| *1533 | P3C.1094702 | Wrench spanner, oil feed tube | 1002 |
| *1540 | P3C.1094703 | Wrench spanner, oil scavenge and vent tubes | 1002 |
| 1926 | S3S.10753000 | Test rig, mobile, oil pressure | 1010 |
| 992 | P3C.1234546 | Adapter, oil pressure test bearing housing | 1010 |
| 812 | P3C.1089483 | Adapter, oil pressure test feed | 1010 |
| 813 | P3C.1089484 | Adapter, oil pressure test scavenge | 1010 |
| * 587 | P3C.1089075 | Mechanical puller, oil jet | 1006 |
| 1659 - | P3C.521456 | Lifting fixture, bearing support Stand, turbine static sub-assembly | 1011 |
| 1322 | P3C.893236 | Guide sleeve, retaining ring | 1011 |
| *1190 | P3C.858916 | Multiple leg sling, CCOC | 1003 |
| 903 | P3C.1223031 | Multiple leg sling, combustion chamber | 1011 |
| *1945 | P5H.1294598 | Protector, combustion chamber | 1011 |
| *3131 | S3S.15951000 | Protector, combustion chamber | 1013 |
| *1014 | P3C.690045 | Pallet, nozzle/combustion chamber | 1003 |
| 246 | P3C.1072876 | Pressure wash block, HP turbine nozzle vanes | 1011 |

Assembly Tools Table 1002 (Continued)

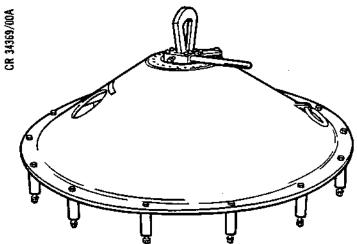
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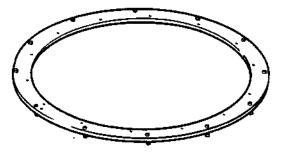


| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|------------------------------|---|------|
| 245 | P3C.1072875 | Pressure wash fixture, HP turbine nozzle vanes | 1011 |
| *1372 | POJ.1077502 | Container, HP turbine nozzle vanes | 1004 |
| 1946 | P5J.1266509 | Support rod retaining ring | 1012 |
| *1155 | P3C.850943 | Multiple leg sling, HP nozzle vanes support cone | 2012 |
| *1556 | P5T.1223028 | Cranked ring wrench, HP nozzle vanes support cone | 1004 |
| 1002 | PJ.1244641 | Protector, bearing support | 1012 |
| 1003 | PJ.1244642 | Protector, bearing support | 1012 |
| 982 | PJ.1234456 | Protector, HP turbine nozzle vanes | 1012 |
| 913 | PJ.1223050 | Protector, LP turbine nozzle vanes | 1012 |
| 1664 | T.530647 | Torque wrench | 1012 |
| 1262 | P3C.865931 | Clamping ring, LP turbine nozzle vanes | 1012 |
| *1310 | PJ.892661 or S3S.10388000 | Lifting fixture, turbine static sub-assembly | 1001 |

Assembly Tools
Table 1002 (Concluded)

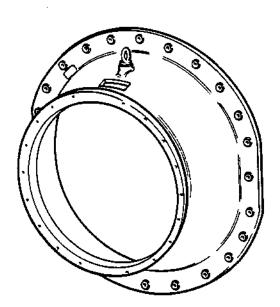




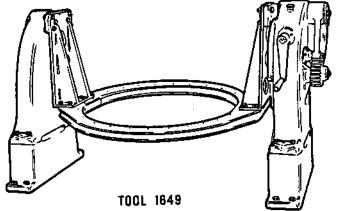


TOOL 1183 1.75 X 48.00 IN DIA (45 X 1220 MW)

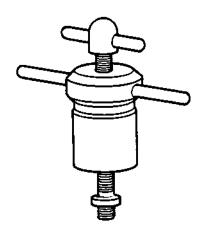
TOOL 1310 22.00 X 43.50 IN DIA (560 X 1105 MM)



TOOL 1157
12.75 X 48.00 IN DIA (325 X 1220 MM)



82.00 X 53.00 X 45.00 IN (2085 X 1350 X 1145 MM)



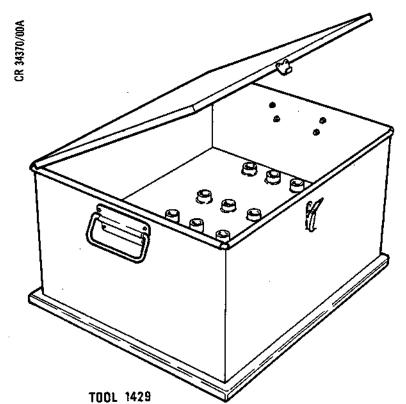
TOOL 416 3.50 X 3.25 X 1.25 IN (90 X 85 X 35 MM)

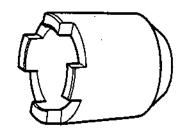
Turbine Static - Special Tools Figure 1001

SPECIAL TOOLS ETC.

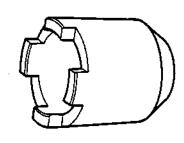
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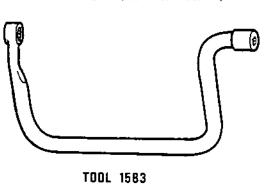


TOOL 1533 1.75 X 1.50 IN DIA (45 X 40 MM)



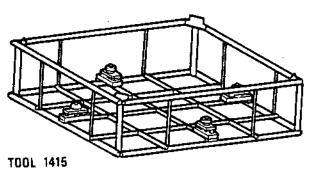
TOOL 1540 1.75 X 1.25 IN DIA (45 X 35 MM)





6.75 X 4.00 X 0.75 IN (175 X 100 X 20 MM)

TOOL 137 5.75 X 2.75 X 0.25 IN DIA (145 X 70 X 10 MM)



24.00 X 24.00 X 7.00 IN (610 X 610 X 175 MM)

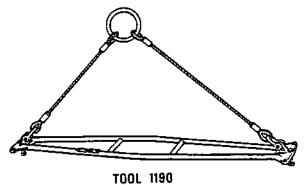
Turbine Static - Special Tools Figure 1002

SPECIAL TOOLS ETC.

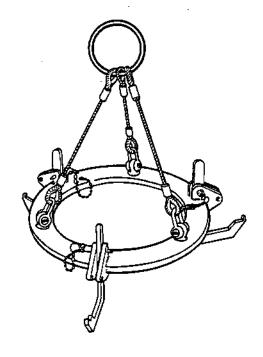
72-00-51 Page 1007 Aug 1/78 MK.610-14-28 OVERHAUL

TOOL 1653

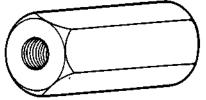
10.50 X 1.50 IN DIA (270 X 40 MM)



47.75 X 29.00 X 7.45 IN (1215 X 740 X 200 MM)

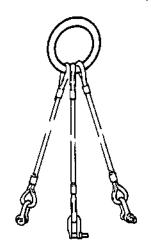


TOOL 1155 35.50 X 25.75 IN DIA (901 X 655 MM)



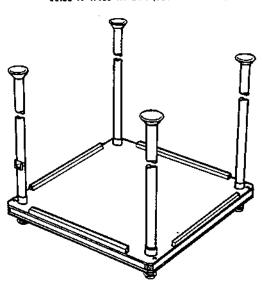
TOOL 859

1.50 X 0.75 IN DIA (40 X 20 MM) -



TOOL 1645

36.00 X 47.00 IN DIA (914 X 1193 MM)



TOOL 1014

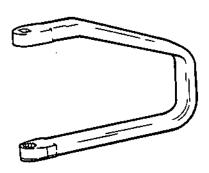
46.00 X 46.00 IN (1168 X 1168 MM) (HEIGHT AS REQUIRED)

Turbine Static - Special Tools Figure 1003

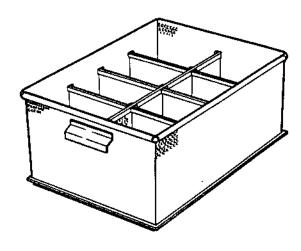
SPECIAL TOOLS ETC.



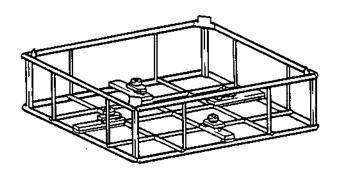
CR 34372/00A



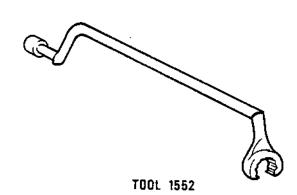
TOOL 1556 6.50 X 4.25 X 1.00 IN (170 X 110 X 25 MM)



TOOL 1372 23.00 X 15.75 X 8.75 IN (600 X 400 X 220 MM)



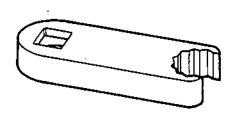
TOOL 1416 28.00 X 28.00 X 7.00 IN (715 X 715 X 175 MM)



25.75 X 3.50 X 1.50 IN (680 X 85 X 40 MM)



TOOL 1546
28.25 X 4.75 X 2.00 IN (715 X 125 X 50 MM)

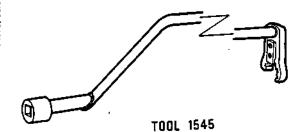


TOOL 1181 2.75 X 1.00 X 0.50 IN (70 X 30 X 15 MM)

Turbine Static - Special Tools Figure 1004

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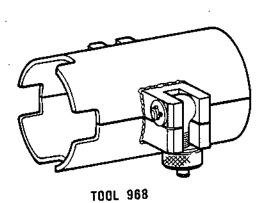




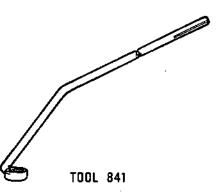
28.25 X 4.75 X 2.00 IN (715 X 125 X 55 MM)



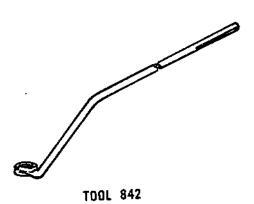
10.00 X 1.75 X 1.00 IN (255 X 45 X 30 MM)



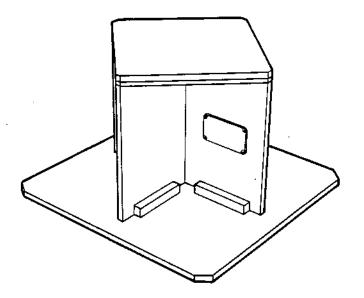
4.25 X 4.00 X 2.25 IN (105 X 100 X 60 MM)



7.75 X 1.25 X 1.00 IN (200 X 35 X 30 MM)



7.75 X 1.25 X 1.00 (N (200 X 35 X 30 MM)

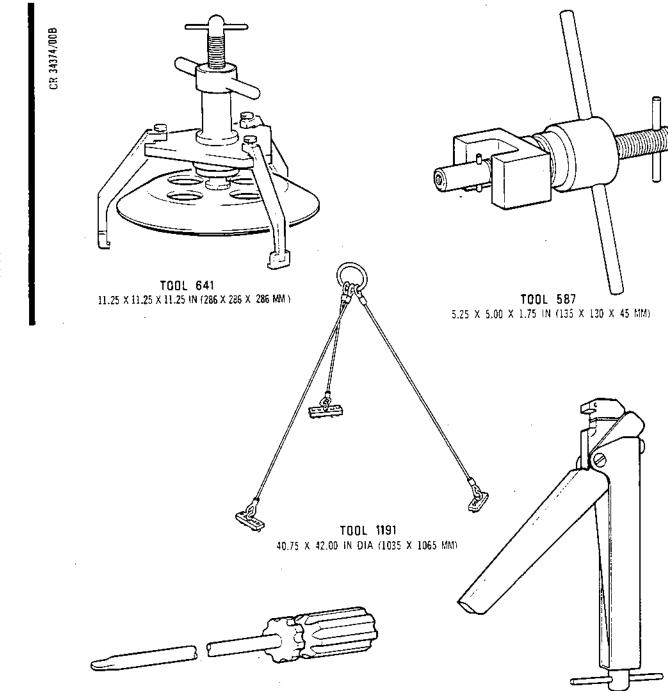


TOOL 1961 20.00 X 20.00 X 13.00 IN (510 X 510 X 330 MM)

Turbine Static - Special Tools Figure 1005

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TN41378



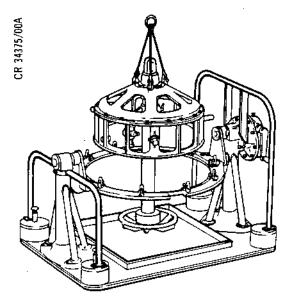
TOOL 1626 8.75 X 1.50 IN DIA (225 X 40 MM)

TOOL 1982 7.50 X 2.50 X 1.00 IN (190 X 65 X 30 MM)

Turbine Static - Special Tools Figure 1006

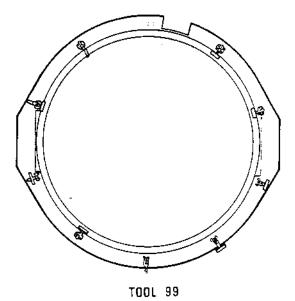
SPECIAL TOOLS ETC. Page 1011 Jan 4/93



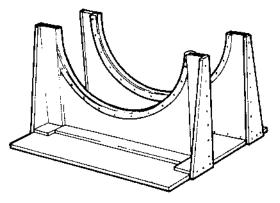


TOOL 1160

80.00 X 59.00 X 48.00 IN (2035 X 1500 X 1220 MM)

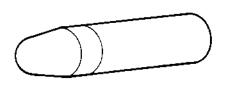


50.00 X 4.75 X 0.75 IN (1270 X 120 X 19 MM)



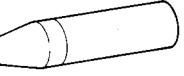
TOOL 95

14.50 X 25.00 X 24.00 IN (370 X 635 X 610 MM)



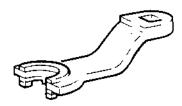
TOOL 1663

2.75 X 0.50 IN DIA (70 X 10 MM)



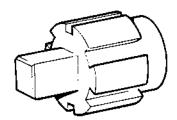
TOOL 1321

1.50 X 0.50 IN DIA (40 MM X 10 MM)



TOOL 694

3.75 X 1.75 X 1.50 IN (100 X 45 X 40 MM)



TOOL 695 2.00 X 1.25 IN DIA (50 X 32 MM)

Turbine Static - Special Tools Figure 1007

SPECIAL TOOLS ETC.

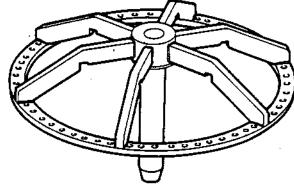
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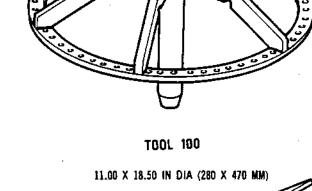


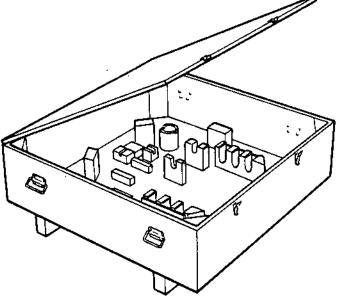
OVERHAUL



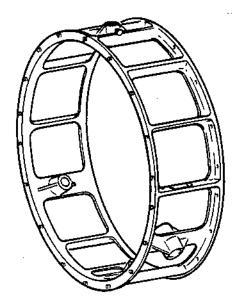
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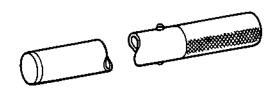




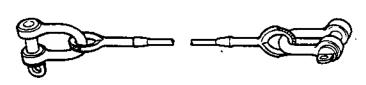
TOOL 1188 42.00 X 41.50 X 16.00 IN (1070 X 1060 X 410 MM)



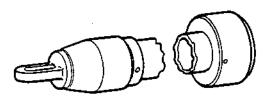
TOOL 101 35.25 X 34.25 X 10.25 IN (890 X 865 X 35 MM)



TOOL 102 21.25 X 1.50 X 1.75 IN (535 X 40 X 45 MM)



TOOL 1573 21.50 X 2.50 IN (545 X 63 MM)



TOOL 103 55.25 X 7.25 IN DIA (1405 X 185 MM)

Turbine Static - Special Tools Figure 1008

SPECIAL TOOLS ETC.

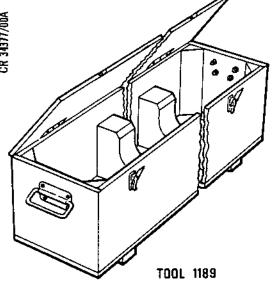
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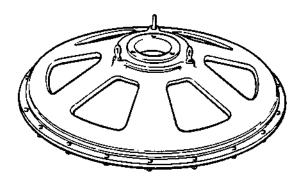
OVERHAUL



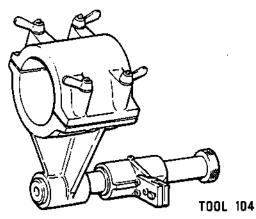




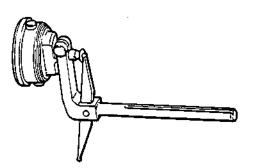
63.75 X 12.50 X 12.25 TN (2460 X 320 X 315 MM)



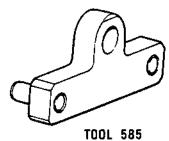
TOOL 1186 8.00 X 34.50 IN DIA (203 X 875 MM)



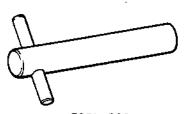
12.50 X 5.50 X 1.25 IN DIA (310 X 140 X 35 MM)



TOOL 1187 6.00 X 8.25 IN (152 X 209 MM)



2.50 X 1.25 X 0.75 IN (65 X 35 X 20 MM)



TOOL 586 2.50 X 1.25 X 0.50 (65 X 35 X 10 MM)

Turbine Static - Special Tools Figure 1009

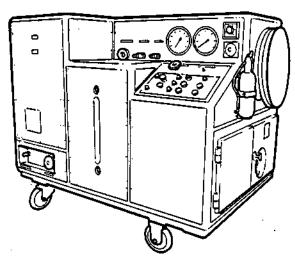
SPECIAL TOOLS ETC.

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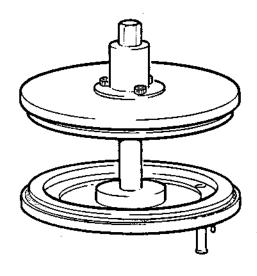


MK.610-14-28 OVERHAUL

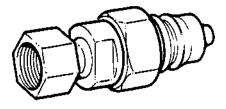
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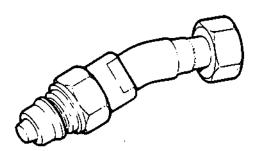
TOOL 1926 71.00 X 57.00 X 45.00 IN (1805 X 1550 X 1145 MM)



TOOL 992 9.00 X 8.00 IN DIA (230 X 205 MM)



TOOL 812 3.75 X 1.50 IN DIA (100 X 40 MM)



TOOL 813 5.75 X 1.75 X 1.50 IN (150 X 45 X 40 MM)

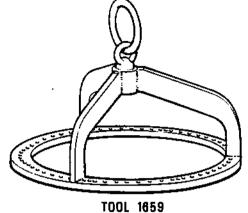
Turbine Static - Special Tools Figure 1010

SPECIAL TOOLS ETC.

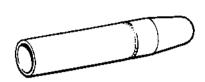
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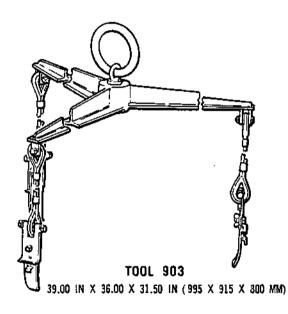




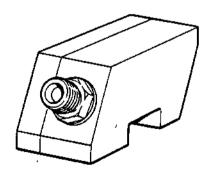
13.75 X 19.00 IN D1A (350 X 480 MM)



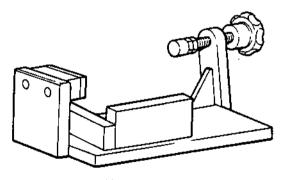
TOOL 1322 1.75 X 0.38 IN DIA (45 X 10 MM)



TOOL 1945 7.75 X 37.50 IN DIA (200 X 955 MM)



TOOL 246 5.00 X 2.00 X 2.00 IN (130 X 55 X 55 MM)



TOOL 245 13.25 X 5.00 X 5.00 IN (340 X 130 X 130 MM)

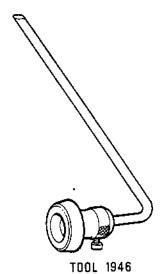
Turbine Static - Special Tools Figure 1011

SPECIAL TOOLS ETC.

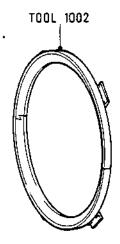




CR 34380/00A



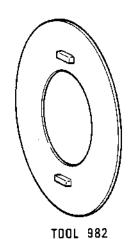
11.00 X 3.00 X 2.00 IN (280 X 80 X 50 MM)



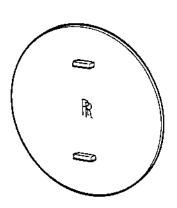
TOOL 1003 0.75 × 16.75 IN DIA (20 X 430 MM)



TOOL 1664 110.50 X 2.75 IN (266 X 69 MM)



1.75 X 39.00 IN DIA (45 X 995 MM)



TOOL 913 1.75 X 39.00 IN DIA (45 X 995 MM)



TOOL 1262 4.50 X 47.75 IN DIA (115 X 1205 MM)

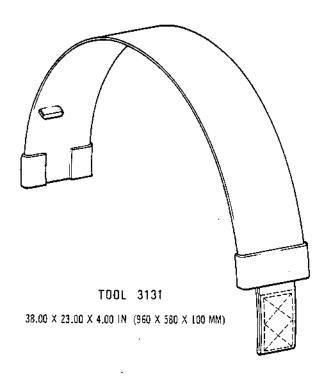
Turbine Static - Special Tools Figure 1012

SPECIAL TOOLS ETC.

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TOOL 3127

5.75 X 1.00 X 1.00 IN (161 X 25 X 25 MM)



Turbine Static - Special Tools Figure 1013

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STANDARD PRACTICES - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

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| | D. | Flow Check Procedure | | | | | 1004 |
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STANDARD PRACTICES - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. Oil Pressure Test Rig

A. General.

- (1) The oil pressure test rig (Tool 1926) is a mobile general purpose rig designed to provide oil over a wide range of temperatures and pressures. The rig has its own self contained electrical and hydraulic system, but relies upon an external 400/440 volts, 3 phase, 30 amp electrical supply.
- (2) The electrical supply is controlled by one ISOLATOR switch which is selected ON or OFF, and in addition, an EMERGENCY STOP button on the control panel can be pressed to cut off the supply. To reconnect the supply, the EMERGENCY STOP button must be pulled up, and the RESET SUPPLY button pushed. This causes the SUPPLY ON light to become illuminated and the SMOG-HOG light to go out.
- (3) All switching and dials are located on two control panels on one side of the rig, which is considered to be the front of the rig. Also located at the front, is the main oil tank sight glass, replenishment connection and the replenishment control valve. The valve must always be open unless replenishing the tank. Behind the sight glass panel is located the 50 gallon (Imperial) (227.3 litre) main oil tank and its drain valve, and alongside the main tank is the small oil flow tank for measuring the flow rate of oil returned to the test rig, and thereby the flow through the unit being tested.
- (4) At the right-hand end of the rig is located the main electrical supply cable stored on a drum, the main electrical isolation switch, and the fire extinguisher for putting out internal fires within the rig.



- (5) Located under a hinged panel on top of the rig is the replenishment hose, and at the left-hand end of the rig is the Smog-hog device vent grid which will emit clean air once the electrical supply is on. The Smog-hog device prevents the spread of noxious fumes caused by the hot oil, and unless the device is operating, the test rig should not be used.
- (6) The rig incorporates heating facilities capable of raising the oil temperature in excess of 200 deg.C. The required oil temperature is set by a selector switch and the heating activated by an ON/OFF HEATER switch. During heating a HEATER ON light will be illuminated, until it is automatically extinguished when the selected temperature is reached. A temperature gauge enables the temperature to be checked at any time.
- (7) Having reached the temperature required, the oil can be pumped from the rig by the PUMP START button activating the hydraulic pump. Whilst running, a PUMP RUNNING light will be illuminated, which will be extinguished when the pump is stopped by operating the PUMP STOP button. The oil pressure leaving the rig is registered on a pressure gauge and controlled by the FLOW STOP VALVE, RETURN STOP VALVE and PRESSURE CONTROLLER.
- The flow rate of the oil is checked by pressing the (8) FLOW CHECK START button which feeds the return oil into the flow tank and a Sensa probe within the tank measures off a gallon of oil. During this period a FLOW CHECK ON light will illuminate and a timer will automatically record the time taken to flow the gallon, while a control unit linked with the probe, will record the flow on a percentage dial gauge and on three lights which indicate 'empty', 'half full' and 'full'. The probe is set to operate at a temperature of 120 deg.C. and if the oil temperature goes below 110 deg.C., the flow check will be inaccurate. Prior to flow checking, the flow tank must be emptied and the timer reset by pressing the DRAIN button, and when empty the TANK EVACUATED light will be illuminated. The timer has four scales which range from 0-24 seconds to 0-4 hours, and prior to flow checking a suitable scale must be selected.

SPECIAL TOOLS ETC.

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- B. Prepare the Oil Test Rig.
 - (1) Ensure that the fire extinguisher is secured to its bracket and is ready for use.
 - (a) The safety pin is in the locked position and the operating plunger is visible.
 - (b) The outlet nozzle is connected to the rig internal spray tube.
 - (2) Ensure that the ISOLATOR lever is in the OFF position, then connect the rig electrical cable to the main 400/440 volts, 3 phase, 30 amp power supply.
 - (3) View the oil tank sight glass and check that the contents are in excess of three quarters full. Refer to para. F. for replenishing procedure.

NOTE: This quantity is required to retain the oil temperature when flowing oil through the sub-assembly being checked.

- (4) Connect hoses to the return and flow connections on the rig and the connections of the sub-assembly being tested as detailed in the appropriate sub-assembly chapter.
- C. Pressure Test Procedure.
 - (1) Turn the ISOLATOR lever to ON, and if the EMERGENCY STOP button is depressed, pull it up, then press the RESET SUPPLY button. Check that the SUPPLY ON light is illuminated, the SMOG-HOG STOPPED light is out, and that a flow of air is detectable at the outlet vent at the left-hand end of the rig.
 - (2) Select the required oil temperature on the temperature selector switch, then turn the HEATER switch to the ON position. Check that the HEATER ON red warning light illuminates. When the HEATER ON warning light extinguishes, check that the correct temperature is reached by checking the oil temperature gauge.
 - (3) Ensure that the FLOW STOP VALVE, the RETURN STOP VALVE and the PRESSURE CONTROLLER valve are fully open.

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- (4) Press the PUMP START button and check that the PUMP RUNNING light illuminates and that pump pressure is indicated on the gauge.
- (5) Flow oil through the sub-assembly at the temperature and pressure, and for the time called for in the appropriate sub-assembly chapter.
- (6) On completion of the oil leak test, continue with the Flow Check (Ref.para. D.) or discontinue the tests and stop the test rig (Ref.para. E.).

D. Flow Check Procedure.

- (1) Prepare the test rig (Ref.para. B.), then start and operate the rig (Ref.para. C.) ensuring that the oil temperature and pressure are as specified in the appropriate sub-assembly chapter.
- (2) Check that the TANK EVACUATED green light is illuminated. If the light is out, press the DRAIN button and hold down till the TANK EVACUATED light illuminates. Check that the timer resets automatically when the drain button is pressed.
- (3) Rotate the timer control knob and select one of the four time scales which range from 0-24 seconds to 0-4 hours.
- (4) Press the FLOW CHECK START button to flow the oil into the measuring compartment. When the oil reaches the measuring position on the Sensa probe, the timer will start, the TANK EVACUATED light will go out and the FLOW CHECK ON light will illuminate. When the FLOW CHECK ON light goes out, read off from the clock the time taken.

NOTE: If the test rig is to the latest standard, the flow of the measured gallon of oil can be seen on the Sensa probe control unit indicator at the bottom of the right-hand end of the rig.

(5) Compare the time taken to flow the gallon (4.55 litre) of oil with the flow rate for the particular subassembly.

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- (6) Evacuate the tank in readiness for the next flow check, by pressing the DRAIN button and holding it down till the TANK EVACUATED light illuminates. Check that the timer resets automatically when the drain button is pressed.
- E. Stopping Procedure.
 - NOTE: Normal stopping procedure is detailed in para.(2) onwards.
 - (1) In the event of an emergency, cut the electrical supply to all circuits by pressing down the EMERGENCY STOP button, or by turning the ISOLATOR lever to OFF.
 - (2) Press the PUMP STOP button and check that the PUMP RUNNING light is extinguished.
 - (3) Turn the HEATER switch to OFF and check that the HEATER ON light is extinguished.
 - (4) Ensure that the FLOW STOP VALVE, RETURN STOP VALVE and the PRESSURE CONTROL valve are fully open.
 - (5) Press the EMERGENCY STOP button and check that the SMOG-HOG STOPPED light is illuminated.
 - (6) Turn the ISOLATOR lever to the OFF position and check that all lights are extinguished.
 - (7) Turn off the main power supply, then disconnect the rig electrical cable from the supply point. Coil the cable onto its drum.
- F. Replenishment Procedure.
 - (1) Open the hatch on top of the rig and remove the replenishment hose from its storage. Connect the hose coupling to the replenishment connection at the bottom left-hand side of the front panel, and insert the plain end of the hose into the storage drum or tank of oil to specification DERD 2497. If the rig oil tank is empty, prime the replenishment hose with oil.

SPECIAL TOOLS ETC.



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- (2) If the oil tank is empty, release and remove the larger of the two panels on the rear of the rig next to the panel marked 'filter access', then slacken the pipe union nut downstream of the pump.
- (3) Check the fire extinguisher and connect the rig to the power supply (Ref.para. C.(1) and (2)).
- (4) Ensure that the FLOW STOP VALVE and REPLENISHMENT CONTROL VALVE are closed, and the PRESSURE CONTROL VALVE is fully open.
- (5) Turn the ISOLATOR lever to ON, and if the EMERGENCY STOP BUTTON is depressed, pull it up, then press the SUPPLY ON button. Check that the SUPPLY ON light is illuminated, the SMOG-HOG STOPPED light is out and that a flow of air is detectable at the outlet vent at the left-hand end of the rig.
- (6) Press the PUMP START button and check that the PUMP RUNNING light illuminates. If the oil tank is empty, watch for the commencement of oil flowing into the tank, then tighten the loose union nut on the pipe. Run the pump until the oil tank is full, then press the PUMP STOP button and check that the PUMP RUNNING light is out. Turn the ISOLATOR lever to OFF. If the panel was removed from the rig, replace and secure the panel.
- (7) Disconnect the replenishment hose from the rig coupling, drain off the surplus oil from the hose, then stow it in its compartment in the top of the rig.



ENGINE TURNING - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 are those required for engine turning.
- B. The tools have been listed in order of usage, and the Tool Ref.No. is the number quoted in the text.
- C. The tools have been illustrated in order of usage and in addition, illustrated in operation (as required) in the appropriate section.

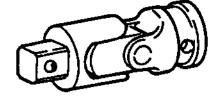
2. Engine Turning Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|--------------------------------------|
| 1872 | PE.22056 | Universal joint | 1001 1001 1001 1001 1001 |
| 1876 | PE.20785 | Adapter assembly | 1001 |
| 1873 | T2.EC.3312 | Extension bar | 1001 |
| 1875 | T2.EP.1594 | Torque adapter | 1001 |
| 1877 | \$3\$12620000 | Pre-set torque wrench, for LP rotor | 1001 |
| 1874 | \$3\$12619000 | Pre-set torque wrench, for HP rotor | 1001 |
| 3147 | \$3\$20255000 | Adapter and immobiliser assembly for LP and HP rotor | 1001 |

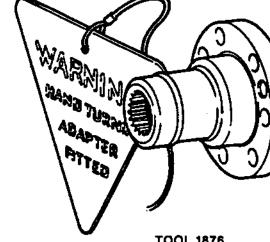
Engine Turning Tools Table 1001



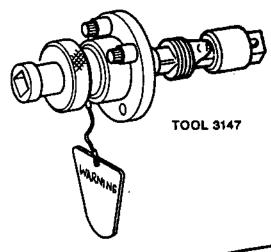
CR 34397/00B 8500000641/2



TOOL 1872 2.75 X 1.00 IN DIA (70 X 25 MM)

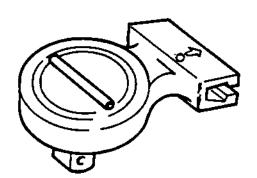


TOOL 1876 5.25 X 5.25 IN DIA (135 X 135 MM)

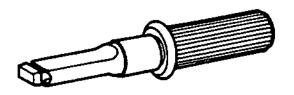


(1)

TOOL 1873 5.00 X 1.00 IN DIA (130 X 25 MM)



TOOL 1875 3.00 X 1.75 IN DIA (80 X 45 MM)



TOOL 1877 8,75 X 1.75 IN DIA (225 X 45 MM)



TOOL 1874 16.00 X 1.50 IN DIA (410 X 40 MM)

Engine Turning - Special Tools Figure 1001

SPECIAL TOOLS, ETC

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ENGINE INTERNAL EXAMINATION - SPECIAL TOOL, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 are those required to carry out the intrascope checks.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text.
- C. The tools have been illustrated in order of usage, and, in addition, illustrated in operation (as required) in the appropriate section.

2. Intrascope Check Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---------------------------------------|-------------|
| | | | |
| 1891 | PE.24099 | Light transmitting cable | 1001 |
| 1888 | PE.24304 | Light source box | 1001 |
| 1899 | PE.15862 | Distal probe | 1001 |
| 1900 | PE.24310 | Transformer | 1001 |
| 1889 | PE.15969 | Probe eye-piece | 1002 |
| 1887 | PE.17283 | Blanking plug extractor | 1003 |
| 1892 | PE.24262 | Probe | 1003 |
| 1893 | S3S 11209000 | <pre>Sleeve (retained on probe)</pre> | 1003 |
| 1894 | PE.15864 | Probe | 1004 |
| 1895 | PE.28892 | <pre>Sleeve (retained on probe)</pre> | 1004 |
| 1896 | PE.15865 | Probe | 1004 |
| 1897 | PE.28888 | <pre>Sleeve (retained on probe)</pre> | 1004 |

SPECIAL TOOLS, ETC.



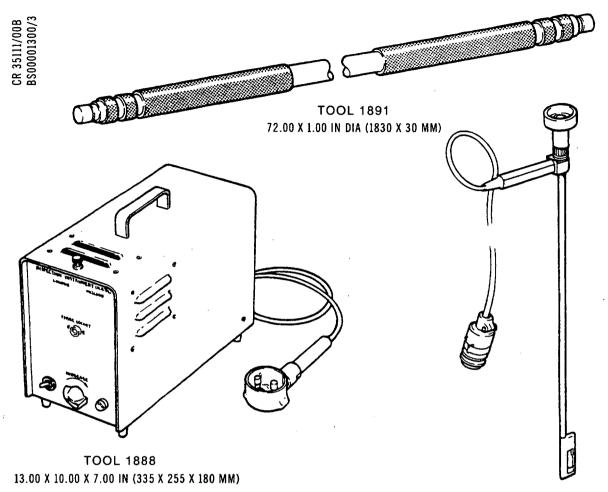
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|----------------------------|-------------|
| 3080 | S3S 11561000 | Probe | 1004 |
| 3081 | s3s 11562000 | Sleeve (retained on probe) | 1004 |
| 1902 | PE.24004 | Probe | 1004 |
| 3082 | PE.24135 | Sleeve (retained on probe) | 1004 |

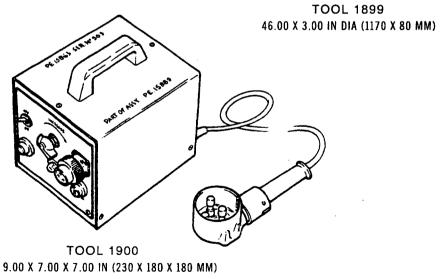
Internal Examination - Special Tools
Table 1001 (Concluded)

SPECIAL TOOLS, ETC.

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Internal Examination - Special Tools Figure 1001

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TOOL 1889 3.00 X 1.75 IN (80 X 45 MM)

Internal Examination - Special Tools Figure 1002

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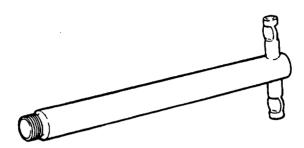


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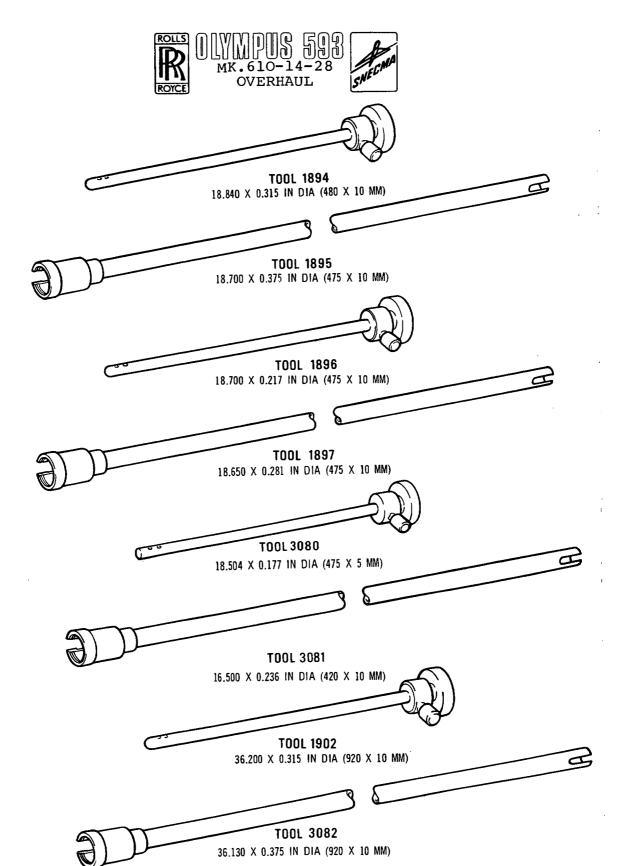
TOOL 1887 6.00 X 2.00 X 0.50 IN DIA (155 X 55 X 15 MM)

TOOL 1892 19.090 X 0.433 IN DIA (485 X 15 MM)

TOOL 1893
19.050 X 0.496 IN DIA (485 X 15 MM)

Internal Examination - Special Tools Figure 1003

SPECIAL TOOLS, ETC.



Internal Examination - Special Tools Figure 1004

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ENGINE INTERNAL EXAMINATION - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 are those required for use in conjunction with optical inspection probes to obtain permanent photographic records of engine internal damage.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text.
- C. Pictorial views of the tools are illustrated and reference to the relevant Fig. No. is included in the table.

2. Photographic Equipment

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|-----------------------|-------------------------|-------------|
| | | | |
| 1903 | PE.15953 | Camera body | 1001 |
| 1904 | PE.15955 | Case | 1001 |
| 1905 | PE.15957 | Adapter | 1001 |
| 1906 | PE.15956 | Lens | 1001 |
| 1907 | PE.15960 | Tripod stand | 1001 |
| 1908 | PE.15958 | Viewfinder | 1002 |
| 1909 | PE.15979 | Camera shutter release | 1002 |
| | | Photographic film H.P.4 | |
| | | (black and white) or | |

ASA408-650 (DIN27.29)

Internal Examination - Special Tools
Table 1001

equivalent

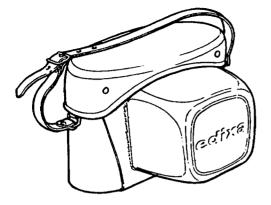
SPECIAL TOOLS, ETC.

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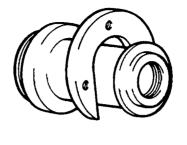


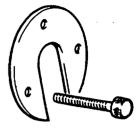
OVERHAUL



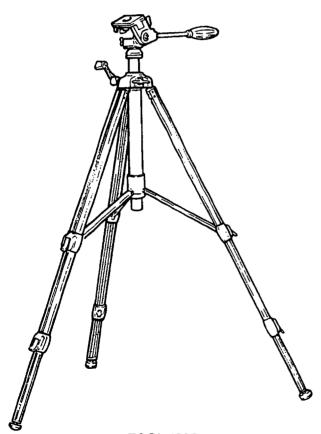


TOOL 1904 6.50 X 4.00 X 2.00 IN. (170 X 105 X 55 MM)

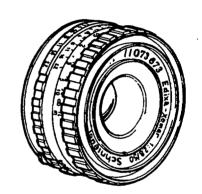




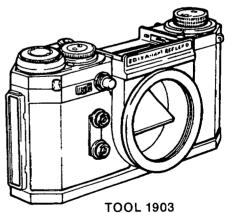
TOOL 1905 3.00 X 2.00 IN. DIA. (80 X 55 MM)



TOOL 1907 36.00 X 8.00 IN. (915 X 205 MM) STOWED



TOOL 1906 2.00 X 2.00 IN. DIA. (55 X 55 MM)



6.00 X 3.50 X 1.50 IN. (155 X 90 X 40 MM)

Internal Examination - Special Tools Figure 1001

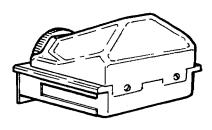
SPECIAL TOOLS, ETC.

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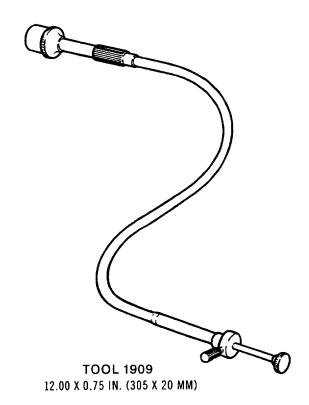


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TOOL 1908 2.25 X 1.00 X 0.75 IN. (60 X 30 X 20 MM)



Internal Examination - Special Tools Figure 1002

SPECIAL TOOLS, ETC.

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AIR INLET SECTION - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble/pressure test the air inlet section.
- B. The tools have been listed in order of usage, and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul and will be duplicated in the tables.
- C. Pictorial views of the tools are illustrated and reference to the relevant Fig. No. is included in the tables.

2. Air Intake Case Disassembly Tools

| TOOL | MANUFACTURER | DECCRIPATION . | FIG. |
|---------------|--------------|------------------------------------|------|
| REF.NO. | PART NO. | DESCRIPTION | NO. |
| *1254 | P3C.862349 | Holding fixture, stand (1320) | 1001 |
| *1320 | P3C.893151 | Stand, air inlet section | 1001 |
| *1255 | P3C.862380 | Multiple leg sling, holding | 1001 |
| | | fixture (1254) | |
| * 894 | P3C.1212284 | Lifting fixture, air intake case | 1001 |
| 1466 | P5J.1255639 | Container, air inlet section items | 1001 |
| * 888 | P3C.1212227 | Puller, filter | 1001 |
| 1879 | PJ.1212224 | Protector, air inlet section | 1002 |
| * 880 | P3C.1212214 | Cranked wrench, oil tube | 1002 |
| * 881 | P3C.1212215 | Cranked wrench, oil feed tube | 1002 |
| *1604 | PT.1234598 | Ring wrench, oil tubes | 1002 |
| *1605 | PT.1234599 | Ring wrench, oil tubes | 1002 |
| 893 | PJ.1299740 | Protector, oil tubes | 1002 |
| * 519 | PJ.1288010 | Adapter, impact puller | 1003 |
| *1690 | P3C.473508 | Impact puller, oil tubes | 1003 |
| * 88 9 | PJ.1212228 | Protector, oil tube | 1003 |
| * 8 79 | P3C.1212213 | Protector, manifold connector | 1003 |
| 1880 | PO.1255689 | Container, anti-icing manifold | 1003 |
| 1983 | PJ.1073088 | Pliers, bearing rollers | 1003 |
| | | · | |

Disassembly Tools
Table 1001

SPECIAL TOOLS ETC.

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3. Air Intake Case Assembly and Oil Pressure Test Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| *1254 | P3C.862349 | Holding fixture, stand (1320) | 1001 |
| *1320 | P3C.893151 | Stand, air inlet section | 1001 |
| *1255 | P3C.862380 | Multiple leg sling, holding fixture (1254) | 1001 |
| * 894 | P3C.1212284 | Lifting fixture, air intake case | 1001 |
| * 879 | P3C.1212213 | Protector, manifold connector | 1003 |
| 885 | P3C.1212222 | Protector, air intake connection | 1004 |
| 878 | P3C,1212212 | Alignment tool, oil tubes | 1004 |
| 1662 | T.527274 | Adapter, wrench (1606), torque checking | 1004 |
| 3131 | S3S15946000 | Tool kit (pipe setting) | 1007 |
| 1606 | PT,1244724 | Cranked ring wrench, oil scavenge tube | 1004 |
| *1604 | PT.1234598 | Ring wrench, oil tubes | 1002 |
| *1605 | PT.1234599 | Ring wrench, oil tubes | 1002 |
| * 880 | P3C.1212214 | Cranked wrench, oil tube | 1002 |
| 1607 | PJ.1244725 | Cranked ring wrench, oil feed tube | 1004 |
| * 881 | P3C.1212215 | Cranked wrench, oil feed tube | 1002 |
| * 889 | PJ.1212228 | Protector, oil tube | 1003 |
| * 519 | PJ.1288010 | Adapter, impact puller | 1003 |
| *1690 | P3C.473508 | Impact puller, oil tubes | 1003 |
| 886 | P3C.1212223 | Protector, filter | 1004 |
| 887 | P3C.1212225 | Protector, air vent | 1005 |
| 1926 | \$35,10753000 | Test rig, mobile, oil pressure | 1005 |
| 884 | | Pressure test blank, bearing | 1005 |
| | PJ.1259792 | housing | |
| 1871 | PJ.1257440 | Adapter, oil pressure test, scavenge tube | 1005 |
| 1001 | P3C,1244625 | Adapter, oil pressure test, inlet tube | 1005 |
| 829 | P3C.1094755 | Protection screen, oil pressure test | 1006 |
| * 888 | P3C.1212227 | Puller, filter- | 1001 |
| 896 | P3C.1212286 | Container, pressure test | 1006 |
| - | - | equipment | |

Assembly and Pressure Test Tools Table 1002 (Continued)

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Page 1002
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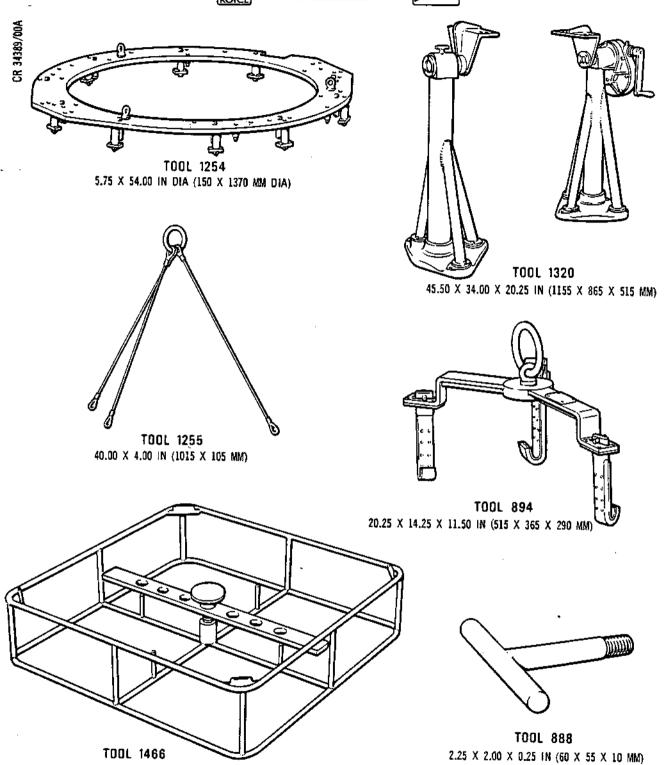


| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| 882 | PJ.1212216 | Protector, labyrinth housing Protector, front inner flange Pallet, air inlet section Lifting fixture, air inlet section | 1006 |
| 904 | PJ.1212226 | | 1006 |
| 905 | PJ.1212287 | | 1006 |
| 890 | P3C.1212230 | | 1006 |

Assembly and Pressure Test Tools Table 1002 (Concluded)

SPECIAL TOOLS ETC.





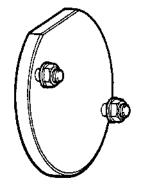
20.25 X 10.25 X 4.75 IN (515 X 515 X 120 MM)

SPECIAL TOOLS ETC.

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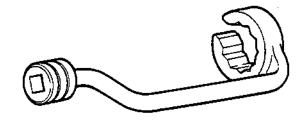


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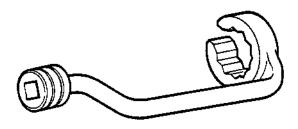
TOOL 1879

1.00 X 4.00 IN DIA (30 X 105 MM)



TOOL 880

6.75 X 2.25 X 1.75 IN (175 X 60 X 45 MM)



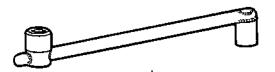
TOOL 881

6.75 X 2.25 X 1.50 IN (175 X 60 X 40 MM)



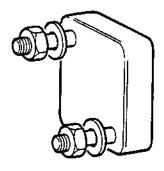
TOOL 1604

8.25 X 1.50 X 0.75 IN (210 X 40 X 20 MM)



TOOL 1605

7.50 X 1.50 X 0.75 IN (195 X 40 X 20 MM)



TOOL 893 -

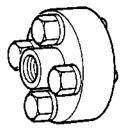
1.50 X 1.50 X 1.25 IN (40 X 40 X 35 MM)

Air Intake Case Assembly - Special Tools Figure 1002

SPECIAL TOOLS ETC.

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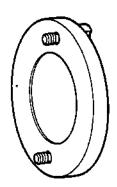
TOOL 519 1.25 X 1.75 IN DIA (35 X 45 MM)



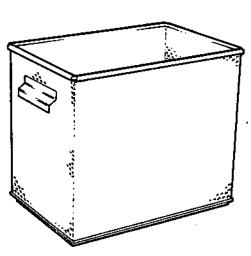
TOOL 1690 3.5 X I.D IN (90 X 25 MM)



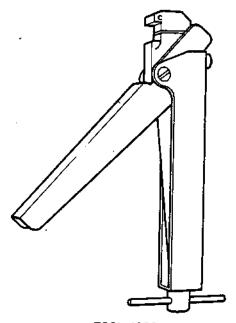
TOOL 889 1.0 X 2.0 IN DIA (25 X 50 MM)



TOOL 879 1.25 X 3.75 IN DTA (35 X 100 MM)



TOOL 1880 16.75 X 14.75 X 10.50 IN (425 X 370 X 265 MM)



TOOL 1983 7.25 X 2.50 X 0.75 IN (185 X 65 X 20 MM)

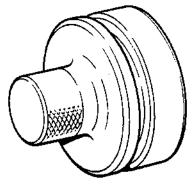
SPECIAL TOOLS ETC.

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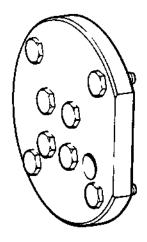




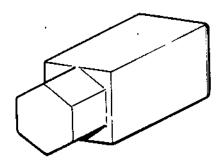




TOOL 885 1.75 X 1.75 IN DIA (45 X 45 MM)



TOOL 878 1.00 X 3.75 IN DIA (30 X 100 MM)



TOOL 1662 1,50 X 0,50 X 0,50 IN (35 X 15 X 15 MM)



7.50 X 2.00 X 1.25 IN (195 X 55 X 35 MM)



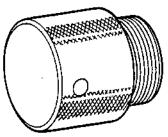
TOOL 1607 6.50 X 2.00 X 1.25 IN (170 X 55 X 35 MM)



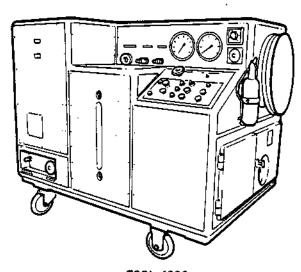
TOOL 886 1.00 X 1.50 IN DIA (30 X 40 MM DIA)

SPECIAL TOOLS ETC.

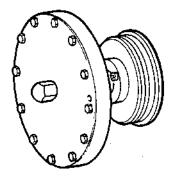
72-20-00 Page 1007 Aug 1/78



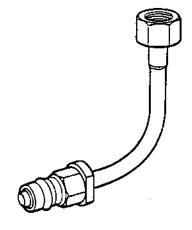
TOOL 887 1.50 X 1.00 IN DIA (40 X 30 MM)



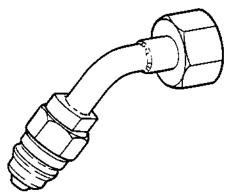
TOOL 1926
71.00 X 57.00 X 45.00 IN (1805 X 1550 X 1145 MM)



TOOL 884 6.00 X 8.00 IN DIA (155 X 205 MM)



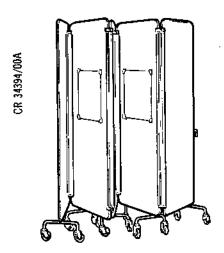
TOOL 1871 - 5.50 X 5.00 X 1.50 IN (140 X 130 X 40 MM)



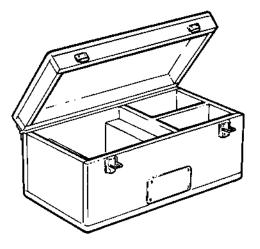
TOOL 1001 5.00 X 3.75 X 1.50 IN (130 X 85 X 40 MM)

SPECIAL TOOLS ETC.

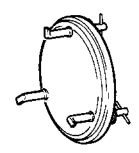
72-20-00 Page 1008 Aug 1/78



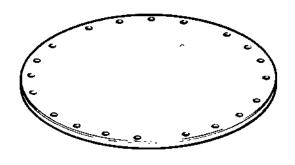
TOOL 829 86.50 X 41.00 X 23.50 IN (2200 X 1045 X 600 MM)



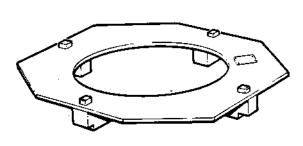
TOOL 896 15.25 X 9.50 X 7.50 IN (390 X 245 X 195 MM)



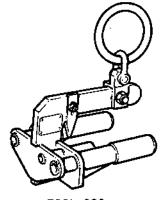
TOOL 882 3.00 X 4.75 IN DIA (80 X 125 MM)



TOOL 904 0.25 X 10.00 IN DIA (10 X 255 MM)



TOOL 905 $_{\rm 48.00~X~48.00~X~5.75~IN~(1220~X~1220~X~150~MM)}$

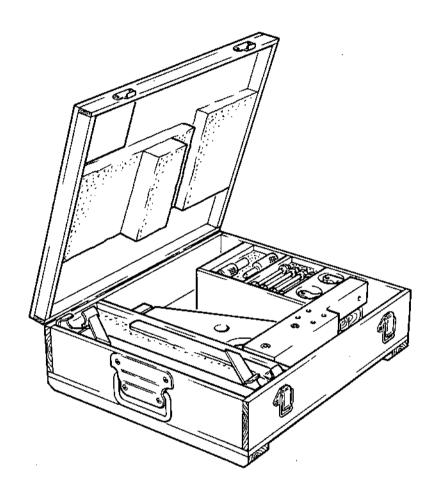


TOOL 890 10.25 X 9.50 X 8.25 IN (265 X 245 X 210 MM)

SPECIAL TOOLS ETC.

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TOOL 3131 16.75 X14.25 X 5.00 IN (420 X 360 X 125 MM)

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Page 1010
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LP COMPRESSOR ASSEMBLY - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the compressor assembly.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. LP Compressor Assembly, Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|--|------|
| *1096 | P3C.699914 | Lifting fixture | 1001 |
| * 588 | P3C.1089083 | Front bearing adapter | 1001 |
| *1097 | P3C.699916 | Trunnion adapter | 1001 |
| *1076 | P3C.695766 | Front support, adapter | 1001 |
| *1306 | P3C.871923 | Rear support, adapter | 1001 |
| * 344 | P3C.1076092 | Rear bearing adapter | 1002 |
| *1056 | P3C.695739 | Beam type sling | 1002 |
| 1098 | P30.699917 | Lifting fixture | 1002 |
| 629 | P30.1089151 | Mechanical puller, front bearing inner track | 1002 |

Disassembly Tools
Table 1001 (Continued)

| TOOL | MANUFACTURER | | FIG |
|---------------|--------------|--|-----|
| REF.NO. | PART NO. | DESCRIPTION | NO. |
| 1214 | PJ.860135 | Platform stand | 100 |
| 1603 | P3C.862330 | Driver, disk bolts | 100 |
| *1166 | P3C.857325 | Blade retainer, stage 1 and 2 blades | 100 |
| *1103 | P3C.699928 | Multiple leg sling, stage 1 disk | 100 |
| *1123 | P3C.699967 | Protection/retaining band, stage 1 blades | 100 |
| *1627 | P3C.896965 | Ring wrench, cranked, disk nuts | 100 |
| * 987 | P3C.1234484 | Turning key, disk bolts | 100 |
| 1610 | P3C.863627 | Mechanical driver, disk bolts | 100 |
| * 443 | P3C.1086775 | Protector, stage 1-2 spacer ring | 100 |
| 1410 | P3C.868923 | Container, stage 1-2, 2-3 and 6-7 spacer rings | 100 |
| 1377 | P5H.1255611 | Container, stage 1 stator vanes | 100 |
| 1440 | PQJ.868964 | Container, inner fixing rings | 100 |
| *1102 | P3C.699927 | Multiple leg sling, stage 2 disk | 100 |
| *1124 | P3C.699968 | Protection/retaining band, stage 2 blades | 100 |
| *1590 | P3C.6957900 | Ring wrench, cranked, disc bolts | 100 |
| 1590 | P3C.695789 | Turning key, disk bolts | 100 |
| 1167 | P3C.857327 | Protector, stage 2-3 spacer ring | 100 |
| 1376 | P5H.1255612 | Container, stage 2 stator vanes | 100 |
| *1161 | PJ.857312 | Lifting fixture, stage 3 to 6 disks | 100 |
| *1125 | P3C.699969 | Protection/retaining band, stage 2 blades | 100 |
| *1 168 | P3C_857328 | Protector, stage 3-4 spacer ring | 100 |
| 1411 | PJ.868924 | Container, stage 3-4, 4-5 and 5-6 spacer rings | 100 |
| 1375 | P5H.1255613 | Container, stage 3 stator vanes | 100 |
| * 1126 | P30.699970 | Protection/retaining band, stage 4 blades | 100 |
| * 627 | P3C.1262699 | Ring wrench, cranked, disk bolts | 100 |
| *1169 | P3C.857329 | Protector, stage 4-5 and 5-6 spacer rings | 100 |
| 1391 | P5H.1255614 | Container, stage 4 stator vanes | 100 |
| *1127 | P3C.699971 | Protection/retaining band, stage 5 blades | 100 |

Disassembly Tools Table 1001 (Continued)

SPECIAL TOOL ETC.

| | | - | | |
|---|-----------------|--------------------------|---|------|
| | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
| _ | | -7-40///00 | | 400 |
| | *1006 | P3C.1244690 | Adjustable support, stage 7 disk | 1007 |
| | *1038 | P3C-695719 | Retaining clip, disk bolts | 1007 |
| | *1065 | P3C.695750 | Assembly pin, disk/spacer ring bolts | 1007 |
| | 1392 | P5H.1255615 | Container, stage 5 stator vanes | 1008 |
| | *1128 | P3C.699972 | Protection/retaining band, stage 6 blades | 1008 |
| | *1101 | PJ.699926 | Multiple leg sling, LP compressor case | 1008 |
| | *1294 | PJ.892957 | Mounting plate, stand (697) | 1008 |
| | * 697 | PJ.1255623 | Turnover build stand, bearing assembly | 1008 |
| | * 696 | P3C.1263656 | Sleeve, immobilizer (1330 and 280) | 1008 |
| | * 280 | P3C.1073102 | Immobilizer, spanner (1594) | 1009 |
| | *1594 | P3C.699924 | Spanner, bearing retaining nut | 1009 |
| | *1022 | P3C.684642 | Torque multiplier, spanner (1594) | 1009 |
| | 1651 | P3C.334809 | Wrench handle, multiplier (1022) | 1009 |
| _ | * 283 | P3C.1073105 | Mechanical puller, bearing assembly | 1009 |
| | * 1095 | P3C.699911 | Support, stage 7 disk | 1010 |
| | *1129 | P3C.699973 | Protection/retaining band, stage 7 blades | 1010 |
| | *1017 | P3C.1244778 | Lifting fixture, rotor shaft rear | 1010 |
| | 1379 | PJ.1077510 | Container, rotor shaft rear | 1010 |
| | *1170 | P3C.857330 | Protector, stage 6-7 spacer ring | 1010 |
| 1 | 3159 | \$38.20207000 | Spacer sleeve | 1020 |
| i | 3161 | \$38.20209000 | Protector | 1020 |
| | 3162 | \$38.20210000 | Protector | 1020 |
| | 3163 | \$38.20674000 | Adaptor assy | 100 |

Disassembly Tools Table 1001 (Concluded)

SPECIAL TOOL ETC.



3. LP Compressor Assembly - Assembly Tools

| TO(RE) | OL F.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------|-------------|-----------------------|---|------|
| 2 | 75 | PG.1246922 | Gauge, setting, rotor shaft rear | 1011 |
| 6 | 98 | PJ.1255593 | Container, gauge (275) | 1011 |
| *10 | 95 | P3C.699911 | Support, stage 7 disk | 1010 |
| 10 | 67 | P3C.695752 | Assembly pins, disk/spacer ring bolts | 1011 |
| *10. | 17 | P3C.1244778 | Lifting fixture, rotor shaft rear | 1010 |
| *10 | 38 | P3C.695719 | Retaining clip, disk bolts | 1007 |
| * 6 | 97 | P3C.1255623 | Turnover build stand, bearing assembly | 1008 |
| • | 72 | P3C.699910 | Setting gauge, rotor shaft | 1011 |
| 1. | 43 | P3C.1065046 | Special nut, setting gauge | 1011 |
| *12 | 94 | PJ.892957 | Mounting plate, stand (697) | 1008 |
| 80 | 06 | P3C.1089450 | Lifting fixture, rotor shaft rear | 1011 |
| 2 | 84 | P3C.1073106 | Adapter, mechanical driver (1099) | 1012 |
| 10 | 99 | P3C.699918 | Mechanical driver, LP bearing assembly | 1012 |
| 11 | 00 | P3C.699922 | Slave packing piece | 1012 |
| 15 | 51 | P3C.1212107 | Hand wrench, bearing retaining nut | 1012 |
| * 6 | 96 | P3C.1263656 | Sleeve, immobilizer (1330 and 280) | 1012 |
| 13 | 30 | P3C.893238 | Immobilizer, wrench (325) | 1012 |
| | 25 | P3C.1073286 | Wrench, bearing retaining nut | 1013 |
| 13 | 33 | P3C.893963 | Multiplier, wrench (325) | 1013 |
| 8 | 05 | P3C.1089449 | Support, rotor shaft rear | 1013 |
| | 43 | P3C.1089448 | Checking gauge, probe ring | 1013 |
| 8. | 24 | P3C.1094720 | Container, checking gauge (43) | 1013 |
| * 2 | 83 | P3C.1073105 | Mechnical puller, bearing assembly | 1009 |
| 10 | 93 | P3C.699901 | Build stand, compressor assembly | 1013 |
| * 3. | 44 | P3C.1076092 | Rear bearing adapter, compressor | 1002 |
| . 3 | 46 | PJ.1076093 | Slave bearing assembly (part of 344) | 1014 |
| 3 | 98 | P3C.1083294 | Slave exit guide vane cases | 1014 |
| 3 | 45 | PJ.1076094 | Slave adjusting washer | 1014 |
| *11 | 29 | P3C.699973 | Protection/retaining band, stage 7 blades | 1010 |
| 12 | 17 | P3C.860141 | Multiple leg sling, stage 7 rotor | 1014 |

Assembly Tools
Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| _ | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---|-----------------|--------------------------|--|------|
| _ | | D70 957740 | Clava halaa alaa (1217) | |
| | 1164 | P30.857319 | Slave bolts, sling (1217) | 1010 |
| | *1170 | P3C.857330 P3C.863649 | Protector, stage 6-7 spacer ring Wrench, rotor/spacer ring bolts | 1015 |
| | 1612 | P30.803049 | Immobilizer, spanner (1594) | 1009 |
| | * 280 | | Spanner, bearing retaining nut | 1009 |
| | *1594 *1022 | PT.699924 P3C.684642 | Torque multiplier, spanner | 1009 |
| | | | (1594) | |
| | 628 | P3C.1257452 | Location sleeve, build stand (1093) | 1015 |
| 1 | * 1096 | P3C.699914 | Lifting fixture, LP compressor | 1001 |
| • | 1219 | PJ.699906 | Slave bearing assembly, rear bearing adapter, stand (697) | 1015 |
| | 559 | P3C.1229381 | Slave bolts, exit guide vane | 1015 |
| | 337 | F3C.1227301 | cases | 1015 |
| | *1006 | P3C.1244690 | Adjustable supports, stage 7 disk | 1007 |
| | *1101 | P3C.699926 | Multiple leg sling, LP compressor case | 1008 |
| ŀ | 1684 | PJ.898002 | Protector/blank, stage 6 stator vanes and blades | 1015 |
| | *1161 | PJ.857312 | Lifting fixture, stage 6 to 3 disks | 1005 |
| | *1128 | P3C.699972 | Protection/retaining band, stage 6 blades | 1008 |
| | 1213 | P30.860133 | Cushion | 1015 |
| | 380 | PJ.1299757 | Alignment rod, assembly pins (1065) | 1016 |
| | 1064 | P3C.695749 | Mechanical puller, rotor/spacer ring bolts | 1016 |
| | 1079 | P3C.695753 | Locating key, rotor/spacer ring bolts | 1016 |
| | 1595 | P3C-699945 | Torque spanner | 1016 |
| | *1169 | PJ.857329 | Protector, stage 5-6 and 4-5 spacer rings | 1007 |

Assembly Tools Table 1002 (Continued)

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 1557 | P3C.1223051 | Wrench, rotor/spacer ring bolts | 1016 |
| *627 | P3C.1262699 | Ring wrench, cranked, disk bolts | 1006 |
| 289 | РЈ.1073112 | Checking gauge, probe vanes | 1016 |
| 1683 | PJ.898005 | Protector/blank, stage 5 stator vanes and blades | 1017 |
| *1065 | P3C.695750 | Assembly pin, disk/spacer ring bolts | 1007 |
| *1127 | P3C.699971 | Protection/retaining band, stage 5 blades | 1007 |
| 1066 | P3C.695751 | Locating key, rotor/spacer ring bolts | 1017 |
| *1126 | P3C.699970 | Protection/retaining band, stage 4 blades | 1006 |
| 1682 | PJ.898004 | Protector/blank, stage 4 stator vanes/blades | 1017 |
| *1168 | PJ.857328 | Protector, stage 3-4 spacer ring | 1006 |
| *1125 | P3C.699969 | Protection/retaining band, stage 3 blades | 1006 |
| 1681 | PJ.898003 | Protector/blank, stage 3 stator vanes/blades | 1017 |
| * 443 | PJ.1086775 | Protector, stage 1-2 spacer ring | 1004 |
| *1591 | P3C.695790 | Ring wrench, cranked, disk bolts | 1005 |
| *1166 | P3C.857325 | Blade retainer, stage 1 and 2 blades | 1003 |
| *1102 | P3C.699927 | Multiple leg sling, stage 2 disk | 1004 |
| *1124 | P3C.699968 | Protection/retaining band, stage 2 blades | 1005 |
| 1680 | PJ.898002 | Protector/blank, stage 2 stator vanes/blades | 1017 |
| * 987 | P3C.1234484 | Turning key, disk bolts | 1003 |
| *1627 | P3C.896965 | Ring wrench, cranked, disk nuts | 1003 |
| *1103 | P3C.699928 | Multiple leg sling, stage 1 disk | 1003 |
| *1123 | P3C.699967 | Protection/retaining band, stage I blades | 1003 |
| 1349 | P3C.898001 | Protector/blank, stage l stator vanes/blades | 1017 |
| 634 | P3C.1089150 | Mechanical driver, roller bearing | 1018 |
| 582 | P3C.1089070 | Guide adapter, rotor shaft front | 1018 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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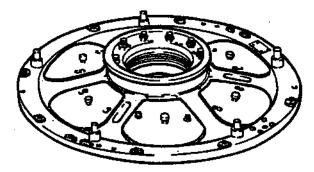
| | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---|-----------------|--------------------------|-----------------------------------|------|
| | * 588 | P3C.1089083 | Front bearing adapter | 1001 |
| | * 1076 | P3C.695766 | Support stand, adapter | 1001 |
| | *1306 | P3C.871923 | Support stand, adapter | 1001 |
| | *1056 | P3C.695736 | Beam type sling | 1002 |
| | 1073 | P3C.695763 | Supports, compressor assembly | 1018 |
| | 1074 | P3C.695764 | Spacer, support (1073) | 1018 |
| | 1075 | P3C.695765 | Spacer, support (1073) | 1019 |
| | 603 | P3C.1089094 | Driving adapter, balancing | 1019 |
| | 660 | PJ.1255513 | Distance piece, adapter (603) | 1019 |
| | 662 | PJ.863636 | Wrench, adapter (603) | 1019 |
| | 661 | PT.863635 | Driving pulley, balancing | 1019 |
| _ | 1572 | PT.860136 | Wrench, adapter (603) | 1019 |
| 1 | *1097 | P3C.699916 | Trunnion adapter | 1001 |
| _ | 1105 | P3C.699931 | Mobile stand, compressor assembly | 1019 |
| | 3157 | S3S.20205000 | Immobiliser | 1020 |
| ì | 3158 | \$38.20206000 | Immobiliser | 1020 |
| | 3159 | \$3\$.20207000 | Spacer sleeve | 1020 |
| | 3160 | \$3\$.20208000 | Stop end | 1020 |
| ı | 3161 | s3s.20209000 | Protector | 1020 |
| 1 | 3162 | s3s.20210000 | Protector | 1020 |
| | 3163 | \$3\$.20674000 | Adaptor assy | 1001 |
| | 3164 | S3S.20727000 | Spanner | 1020 |

Assembly Tools Table 1002 (Concluded)

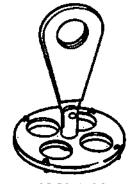


K.610-14-2 Overhaul

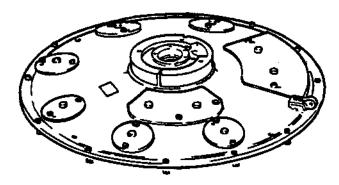




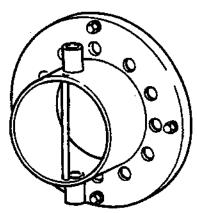
TOOL 3163 D 6.50 X 36.50 IN. (165 X 930 MM)



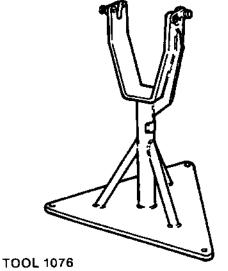
TOOL 1096 D 15.50 X 10.75 IN. (395 X 275 MM)



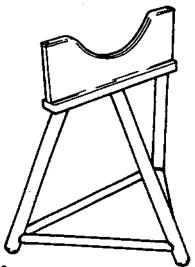
TOOL 588 D 8.00 X 49.00 IN. (205 X 1245 MM)



TOOL 1097 D 4.75 X 10.75 IN. (125 X 275 MM)



30.50 X 22.50 X 19.75 IN. (775 X 575 X 505 MM)

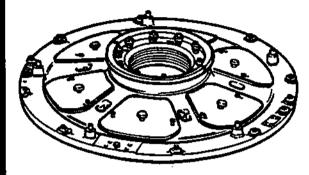


TOOL 1306 D 26.00 X 26.00 X 16.75 IN. (665 X 665 X 430 MM)

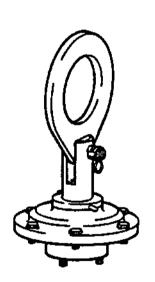
LP Compressor Assembly - Special Tools Figure 1001

SPECIAL TOOL ETC.

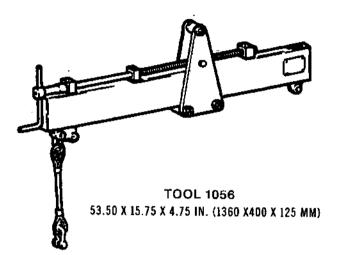
72-31-00 Page 1008 Dec 31/00 CR 34430/00B BS00000674/2

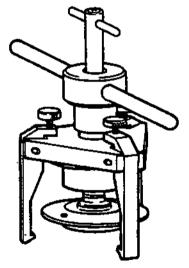


TOOL 344 D 6.50 X 36.50 IN. (165 X 930 MM)



TOOL 1098 12.25 X 6.50 IN. (315 X 165 MM)





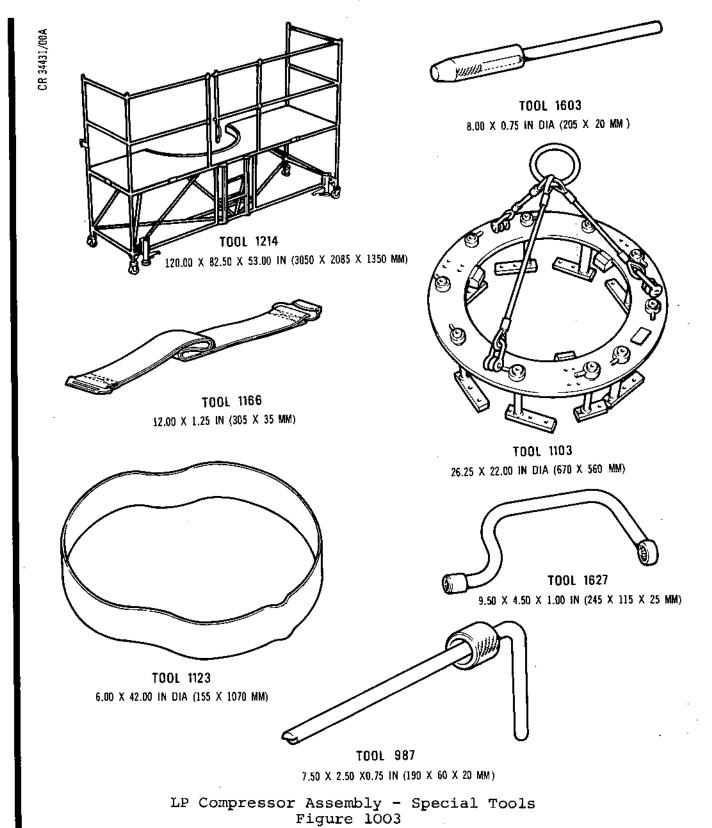
TOOL 629 11.50 X 10.00 IN. (295 X 255 MM)

LP Compressor Assembly - Special Tools Figure 1002

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SPECIAL TOOLS ETC.

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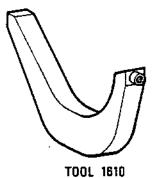
Aug 1/78



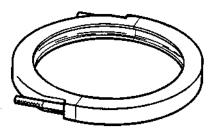
MK.610-14-28 OVERHAUL



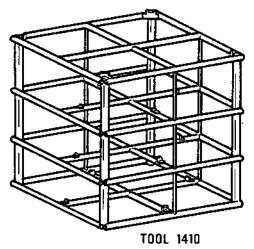




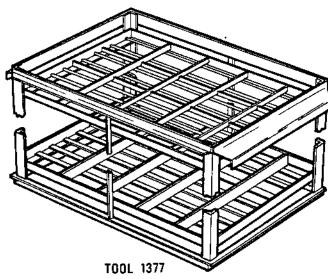
8.25 X 4.00 X 0.75 IN (210 X 100 X 20 MM)



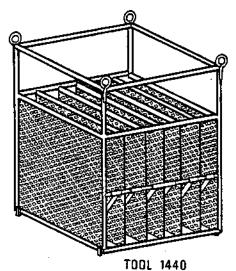
TOOL 443 14.00 X 14.00 X 1.50 IN (355 X 355 X 35 MM)



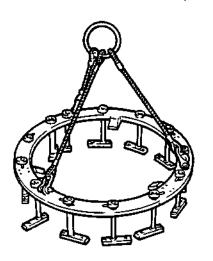
20.00 X 20.00 X 19.25 IN (510 X 510 X 490 MM)



23.00 X 16.50 X 16.00 IN (585 X 420 X 410 MM)



24.50 X 21.25 X 18.25 IN (620 X 540 X 465 MM)

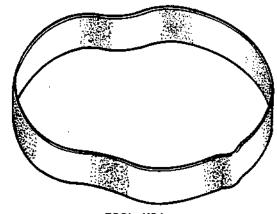


TOOL 1102 28.50 X 23.25 IN DIA (725 X 590 MM)

LP Compressor Assembly - Special Tools Figure 1004

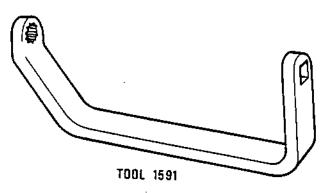
72-31-00

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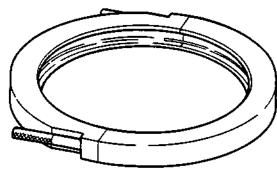


TOOL 1124

5.00 X 40.00 IN DIA (130 X 1020 MM)

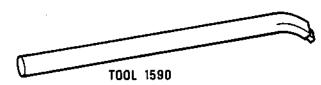


7.75 X 3.00 IN (200 X 80 MM)

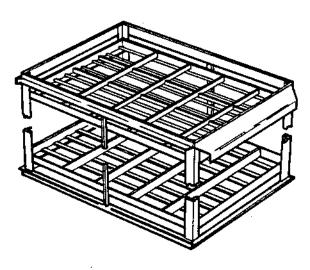


TOOL 1167

17.75 X 1.50 IN (450 X 40 MM)

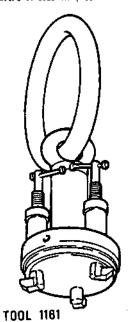


3.75 X 0.50 IN (95 X 15 MM)



TOOL 1376

23,00 X 16,00 X 14,50 IN (585 X 410 X 370 MM)



9.75 X 5.25 X 3.00 IN (250 X 135 X 80 MM)

LP Compressor Assembly - Special Tools Figure 1005

SPECIAL TOOLS ETC.

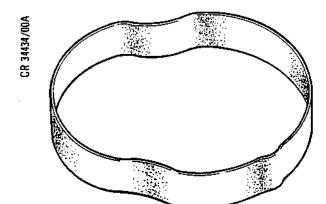
Page 1012 Aug 1/78



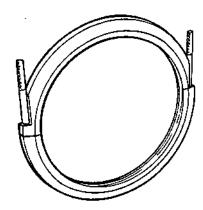
OLYMPUS 593

MK.610-14-28 OVERHAUL

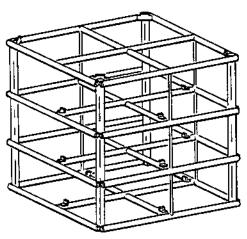




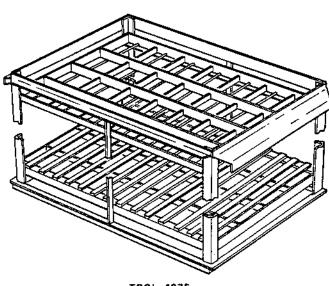
TOOL 1125 4.00 X 38.00 IN DIA (105 X 970 MM)



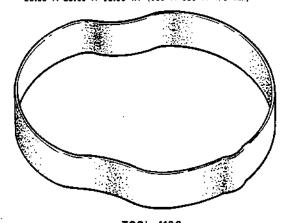
TOOL 1168 17.50 X 1.50 IN (445 X 40 MM)



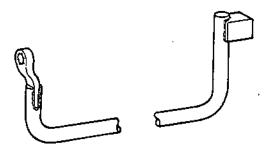
TOOL 1411 20.00 X 20.00 X 18.50 IN (510 X 510 X 470 MM)



TOOL 1375 23.00 X 16.00 X 13.50 IN (585 X 410 X 345 MM)



TOOL 1126 4.00 X 36.00 IN DIA (105 X 915 MM)



TOOL 627 19.50 X 2.75 X 1.00 IN (495 X 70 X 25 MM)

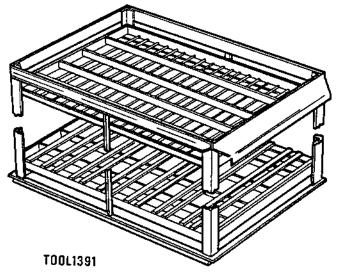
LP Compressor Assembly - Special Tools Figure 1006

SPECIAL TOOLS ETC.

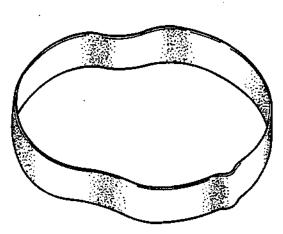
72-31-00

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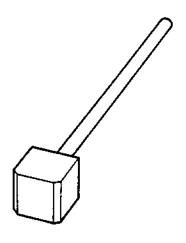
TOOL 1169 18.00 X 1.50 IN (460 X 40 MM)



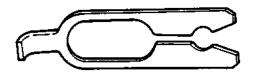
23.00 X 16.00 X 12.25 IN (585 X 410 X 315 MM)



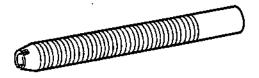
TOOL 1127 4.00 X 34.00 IN DIA (105 X 865 MM)



TOOL 1006 15.00 X 2.00 X 2.00 IN (385 X 55 X 55 MM)



TOOL 1038 0.75 X 2.75 X 0.50 IN (20 X 70 X 15 MM)



TOOL 1065 3.75 X 0.50 IN DIA (100 X 15 MM)

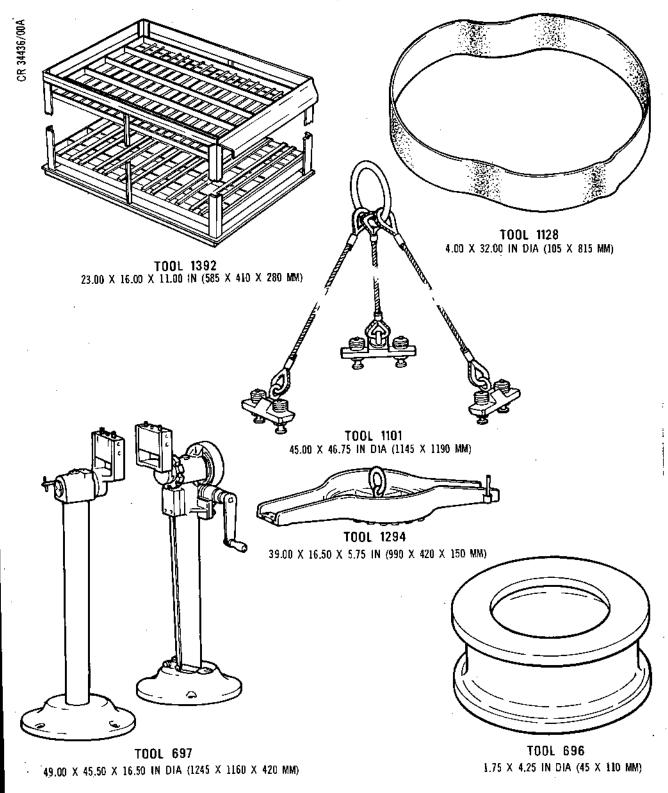
LP Compressor Assembly - Special Tools Figure 1007

SPECIAL TOOLS ETC.

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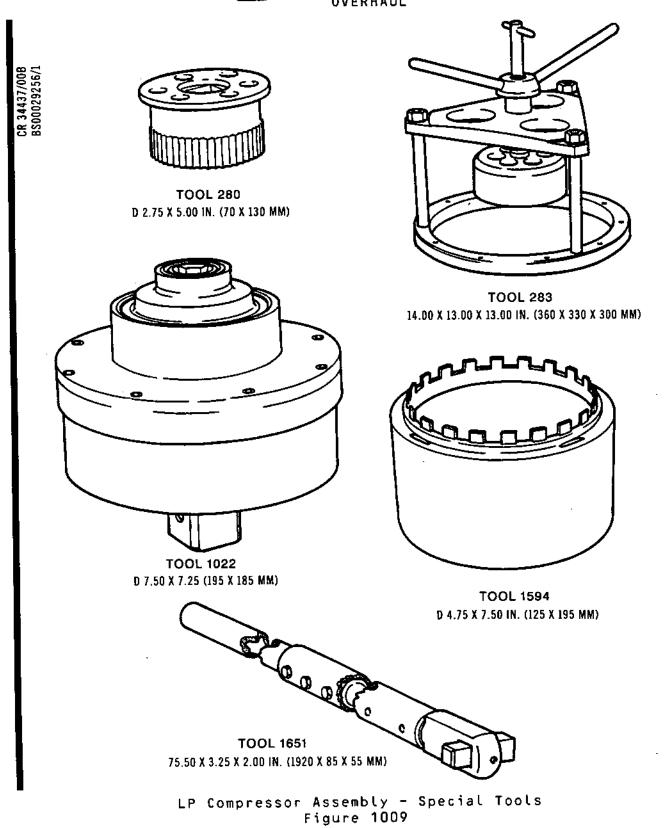


LP Compressor Assembly - Special Tools Figure 1008

SPECIAL TOOLS ETC.

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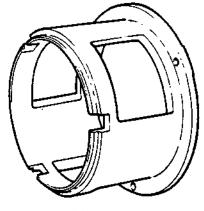
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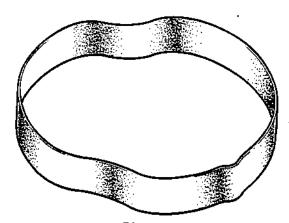
SPECIAL TOOL ETC.

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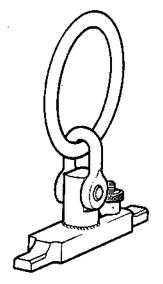




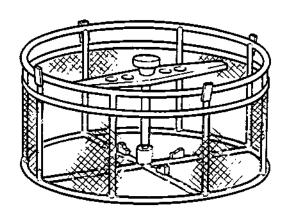
TOOL 1095 7.50 X 14.00 IN DIA (195 X 360 MM)



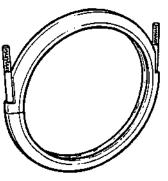
TOOL 1129 4.00 X 30.00 IN DIA (105 X 765 MM)



TOOL 1017 9.25 X 5.50 X 2.25 IN (235 X 140 X 60 MM)



TOOL 1379 14.75 X 19.75 IN DIA (375 X 505 MM)



TOOL 1170 18.00 X 1.50 IN (460 X 40 MM)

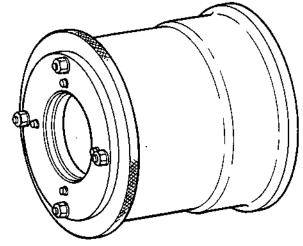
LP Compressor Assembly - Special Tools Figure 1010

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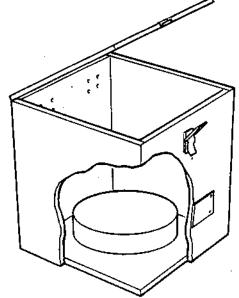
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OVERHAUL

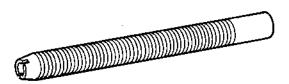




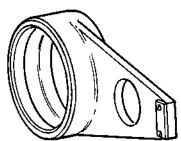
TOOL 275 7.25 X 6.50 IN DIA (185 X 165 MM)



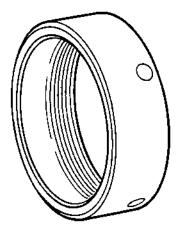
TOOL 698 8.50 X 7.50 X 7.50 IN (220 X 195 X 195 MM)



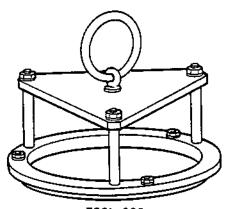
TOOL 1067 6.25 X 0.50 IN DIA (160 X 15 MM)



TOOL 72 13.00 X 6.25 X 2.50 IN (330 X 160 X 65 MM)



TOOL 143 1.50 X 6.25 IN DIA (40 X 160 MM)



TOOL 806 6.50 X 12.75 IN DIA (165 X 325 MM)

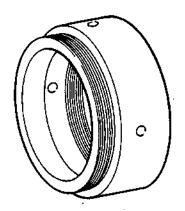
LP Compressor Assembly - Special Tools Figure 1011

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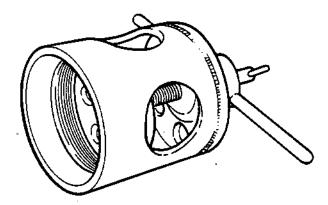
TN40884



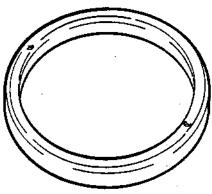




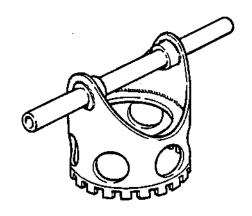
TOOL 284 2.50 X 5.50 IN DIA (65 X140 MM)



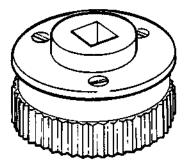
TOOL 1099 12.50 X 11.25 X 6.00 IN (320 X 290 X 155 MM)



TOOL 1100 0.75 X 6.50 IN DIA (20 X 165 MM)



TOOL 1551 15.00 X 7.00 IN (385 X 180 MM)

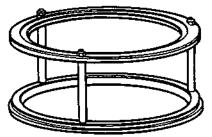


TOOL 1330 2.75 X 4.75 IN DIA (70 X 125 MM)

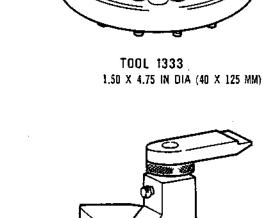
LP Compressor Assembly - Special Tools Figure 1012

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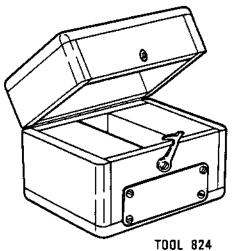
TOOL 325 10.75 X 3.00 X 9.25 IN DIA (275 X 80 X 235 MM)



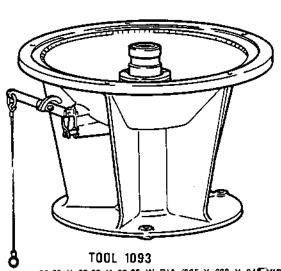
TOOL 805 9.25 X 22.00 IN DIA (235 X 560 MM)



TOOL 43 3.75 X 3.50 X 2.75 IN (95 X 90 X 70 MM)



TOOL 824 5.00 X 4.75 X 4.25 IN (130 X 125 X 110 MM)



38.00 X 23.50 X 33.25 IN DIA (965 X 600 X 845 MM)

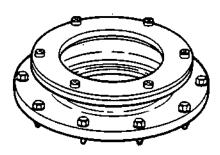
LP Compressor Assembly - Special Tools Figure 1013

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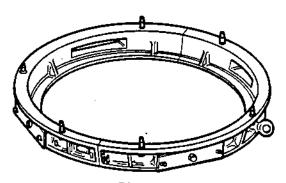
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CR 3442/00A



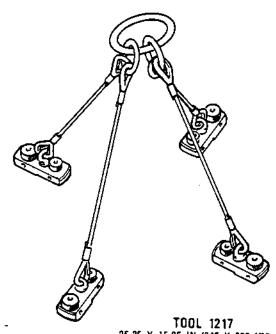
TOOL 346 3.25 X 12.50 IN DIA (85 X 320 MM)



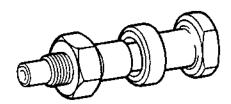
TOOL 398 39.50 X 5.50 X 38.75 IN DIA (1005 X 140 X 985 MM)



TOOL 345 0.50 X 6.50 IN DIA (15 X 165 MM)



TOOL 1217 25.25 X 15.25 IN (645 X 390 MM)



TOOL 1164 1.75 X 0.75 IN (45 X 20 MM)

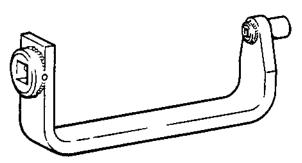
LP Compressor Assembly - Special Tools Figure 1014

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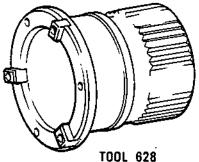
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OVERHAUL

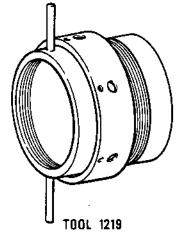




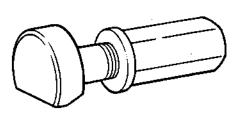
TOOL 1612 6.00 X 2.00 X 0.75 IN (155 X 55 X 20 MM)



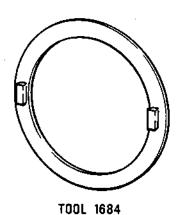
6.00 X 5.25 IN DIA (155 X 135 MM)



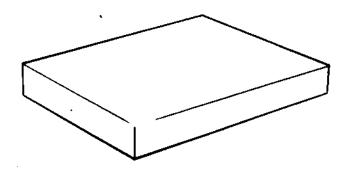
14.25 X 9.00 X 7.00 IN (365 X 230 X 180 MM)



TOOL 559 2.00 X 0.75 IN DIA (55 X 20 MM)



1.75 X 42.00 IN DIA (45 X 1070 MM)



TOOL 1213 24.00 X 24.00 X 3.50 IN (610 X 610 X 90 MM)

LP Compressor Assembly - Special Tools Figure 1015

SPECIAL TOOLS ETC.

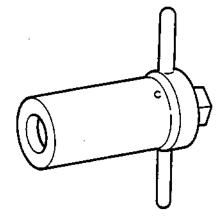
72-31-00

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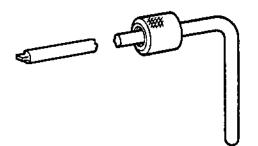




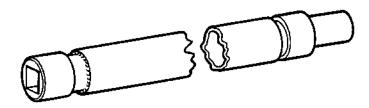
TOOL 380 23.75 X 0.25 IN DIA (600 X 10 MM)



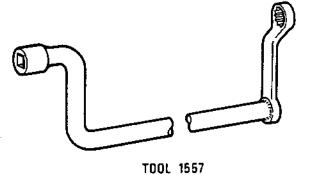
TOOL 1064 3.00 X 3.00 X 1.25 IN DIA (80 X 80 X 35 MM)



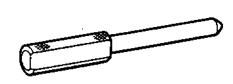
TOOL 1079
7.50 X 2.25 X 0.75 IN DIA (190 X 60 X 20 MM)



TOOL 1595 26,50 X 0,75 IN DIA (675 X 20 MM)



20.25 X 4.00 X 0.75 IN (515 X 105 X 20 MM)

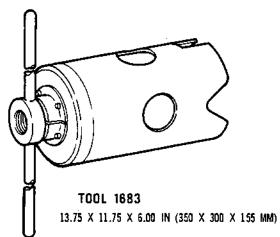


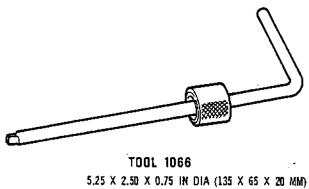
TOOL 289
3.50 X 0.50 IN DIA (90 X 15 MM)

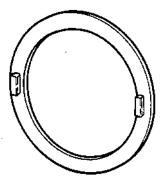
LP Compressor Assembly - Special Tools Figure 1016

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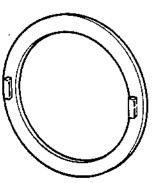




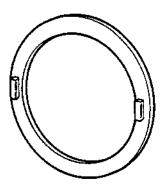




TOOL 1682 1.75 X 38.25 IN DIA (45 X 975 MM)



TOOL 1681 1.75 X 40.00 IN DIA (45 X 1020 MM)



TOOL 1680 1.75 X 42.00 IN DIA (45 X 1070 MM)

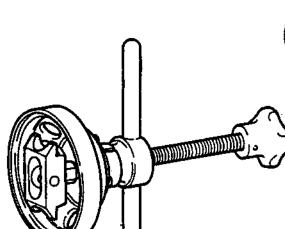


TOOL 1349 1.75 X 44.00 IN DIA (45 X 1120 MM)

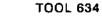
LP Compressor Assembly - Special Tools Figure 1017

SPECIAL TOOLS ETC. Page 1024 Aug 1/78

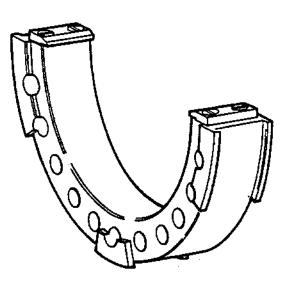
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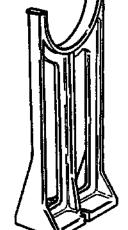
TOOL 582 D 1.50 X 4.50 IN. (40 X 115 MM)



9.75 X 8.75 X 4.50 IN. (250 X 225 X 115 MM)



TOOL 1074 13.50 X 7.00 X 2.50 IN. (345 X 180 X 65 MM)



TOOL 1073

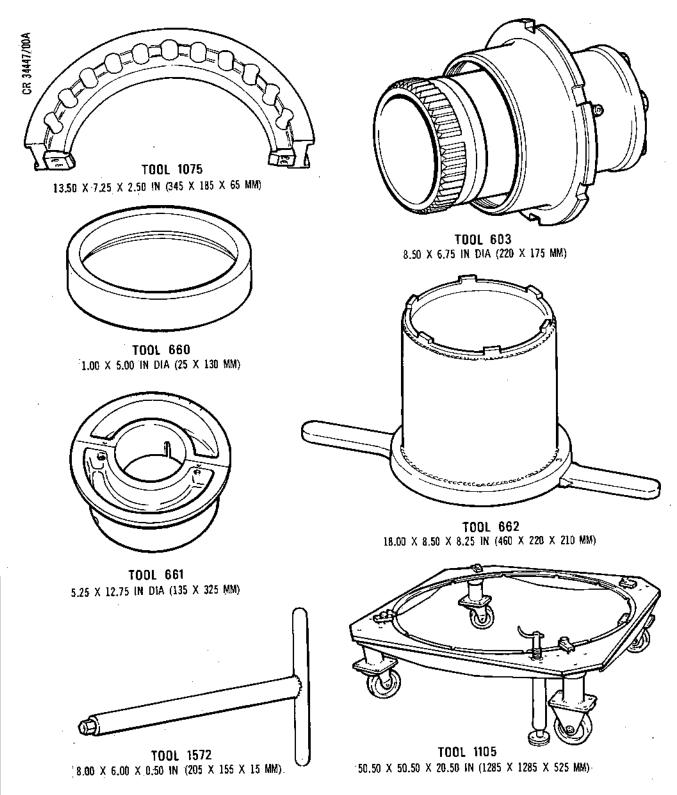
30.50 X 15.00 X 9.50 IN. (775 X 385 X 245 MM)

LP Compressor Assembly - Special Tools Figure 1018

SPECIAL TOOL ETC.

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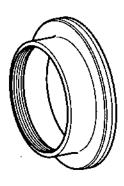


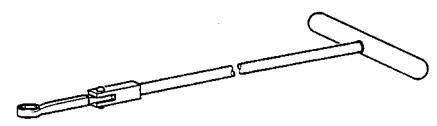


LP Compressor Assembly - Special Tools Figure 1019

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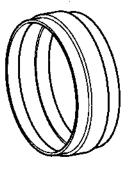
Page 1026 Aug 1/78 BS00029538/1



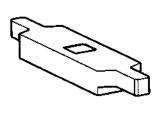


TOOL 3132 18.50 X 4.00 X 0.50 IN. (470 X 105 X 10 MM)

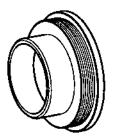




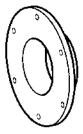




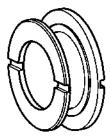
TOOL 3164



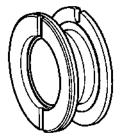
TOOL 3157



TOOL 3160



TOOL 3161



TOOL 3162

LP Compressor Assembly - Special Tools Figure 1020

SPECIAL TOOL ETC.

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LP COMPRESSOR CASE AND VANES - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the stage 6 stator vanes.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. LP Compressor Case and Vanes, Disassembly Tools

| | OOL F.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---|--------------|---------------------------|---|------|
| * | | P3C.893145 P5H.1255616 | Stand, LP case Container, stage 6 stator | 1001 |
| | 1440 | POJ.868964 | <pre>vanes Container, stage 1-6 fixing</pre> | 1001 |
| * | 1178 | P3C.857361 | rings Multiple leg sling, LP compressor | 1001 |

Disassembly Tools Table 1001

SPECIAL TOOLS ETC.

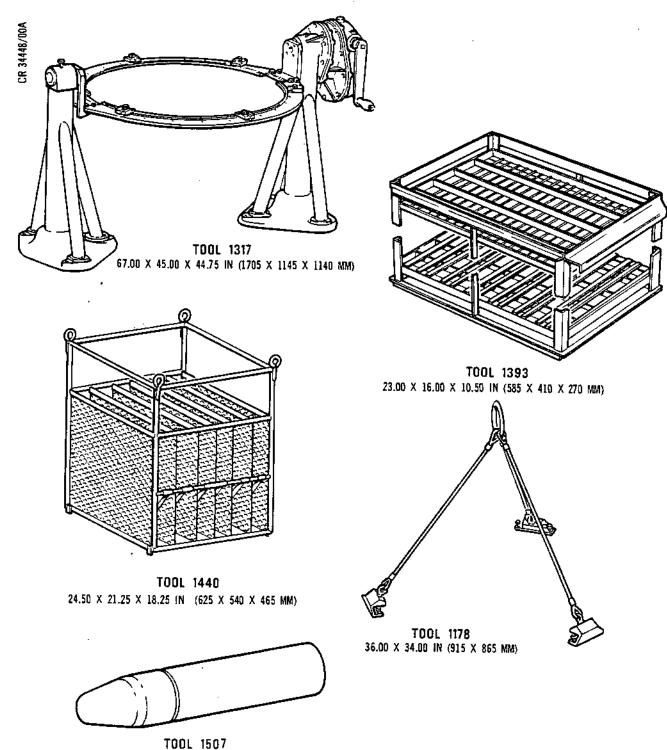


3. LP Compressor Case and Vanes, Assembly Tools

| | | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|---|------|--------------------------|--------------------------------------|-------------|
| * | 1178 | P3C.857361 | Multiple leg sling, LP compressor | 1001 |
| * | 1317 | P3C.893145 | Stand, LP case | 1001 |
| | | P3C.1073163 | Assembly sleeve, retaining rings | 1001 |
| | 302 | P3C.1073169 | Driver, retaining rings | 1002 |
| | 926 | P3C.1223199 | Immobilizer, LP compressor bolts | 1002 |
| | 3134 | \$3\$15888000 | Tool restraining | 1003 |
| | 3140 | S3S15894000 | Protector, retaining | 1003 |
| | 289 | P3C.1073112 | Gauge pin, LP compressor stator vane | 1002 |
| | 1506 | P3C.1073162 | Assembly sleeve, retaining rings | 1002 |
| | 301 | P3C.1073168 | Driver, retaining rings | 1002 |
| | 3137 | \$3\$15891000 | Protector, retaining | 1003 |
| | 3138 | S3S15892000 | Protector, retaining | 1003 |
| | 3139 | s3\$15893000 | Protector, retaining | 1003 |

Assembly Tools
Table 1002



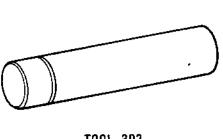


LP Compressor Case and Vanes - Special Tools Figure 1001

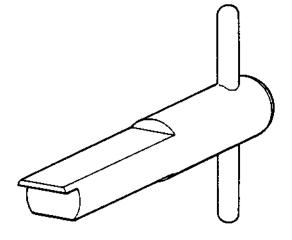
1.75 X 0.50 IN DIA (45 X 10 MM)

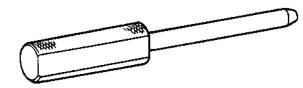
SPECIAL TOOLS ETC.

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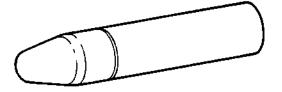


TOOL 302 2.00 X 0.50 IN DIA (55 X 15 MM)

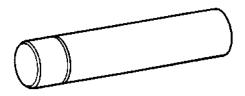




TOOL 289 3.50 X 0.50 IN DIA (90 X 15 MM)



TOOL 1506 1.75 X 0.50 IN DIA (45 X E5 MM)



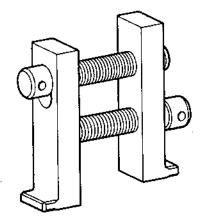
TOOL 301 2.25 X 0.50 IN DIA (60 X L5 MM)

LP Compressor Case and Vanes - Special Tools Figure 1002

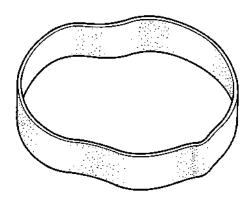
SPECIAL TOOLS ETC.

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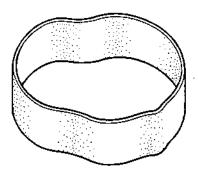




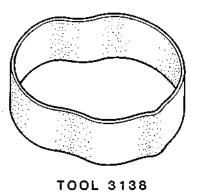
TOOL 3134 3.00 X 2.25 X 0.75 IN (75 X 55 X 15 MM)



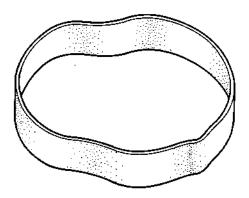
TOOL 3140 3.00 X 17.25 IN DIA (75 X 435 MM)



TOOL 3137 4.00 X 14.25 IN DIA (100 X 360 MM)



4.00 X 15.75 IN DIA (100 X 395 MM)



TOOL 3139 3.00 X 17.00 IN DIA (75 X 430 MM)

LP Compressor Case and Vanes - Special Tools Figure 1003

SPECIAL TOOLS ETC.

<u>LP COMPRESSOR ROTOR - SPECIAL TOOLS, FIXTURES AND EQUIPMENT</u>

1. <u>General</u>

- A. The special tools, fixtures and equipment listed in Table 1001 are those required to disassemble the LP compressor rotor. Tools listed in Table 1002 are those required to mass moment weigh the rotor blades. Tables 1003 and 1004 list tools required for horizontal and vertical static balance procedures respectively. Tools listed in Table 1005 are those required for Inspection/Check.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. LP Compressor Rotor Disassembly Tools

| MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|--------------------------|--|---|
| P3C.1083347 | Lifting fixture, stage 1 disk | 1001 |
| PJ.892824 | Support, disks | 1001 |
| P5H.1255631 | Container, stage 1 blades | 1001 |
| P0.868922 | Container, stage 1 disk | 1001 |
| P3C.867251 | Multiple leg sling, stage 2 disk | 1001 |
| P5H.1255632 | Container, stage 2 blades | 1002 |
| PO.868920 | Container, stage 1, 4, 5 and 6 disks | 1002 |
| P3C.860141 | Multiple leg sling, stage 3-7 disks | 1002 |
| P3C.1083237 | <pre>Slave bolts, stage 3 disk/spacer (1217)</pre> | 1002 |
| P5H.1255633 | Container, stage 3 blades | 1002 |
| P0.868921 | Container, stage 3 disk | 1002 |
| P3C.1083378 | Slave bolts, stage 4 and 5 | |
| | disk/spacer (1217) | 1003 |
| | PART NO. P3C.1083347 PJ.892824 P5H.1255631 P0.868922 P3C.867251 P5H.1255632 P0.868920 P3C.860141 P3C.1083237 P5H.1255633 P0.868921 | PART NO. P3C.1083347 Lifting fixture, stage 1 disk PJ.892824 Support, disks P5H.1255631 Container, stage 1 blades P0.868922 Container, stage 1 disk P3C.867251 Multiple leg sling, stage 2 disk P5H.1255632 Container, stage 2 blades P0.868920 Container, stage 1, 4, 5 and 6 disks P3C.860141 Multiple leg sling, stage 3-7 disks P3C.1083237 Slave bolts, stage 3 disk/spacer (1217) P5H.1255633 Container, stage 3 blades P0.868921 Container, stage 3 disk P3C.1083378 Slave bolts, stage 4 and 5 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|----------------------------------|------|
| *1398 | P5H.1255634 | Container, stage 4 blades | 1003 |
| *1399 | P5H.1255635 | Container, stage 5 blades | 1003 |
| * 368 | P3C.1083238 | Slave bolt, stage 6 disk/spacer | |
| | | (1217) | 1003 |
| *1464 | P5H.1255636 | Container, stage 6 blades | 1004 |
| *1164 | P3C.857319 | Slave bolts, stage 7 disk (1217) | 1004 |
| *1465 | P5H.1255637 | Container, stage 7 blades | 1004 |
| *1406 | PO.868919 | Container, stage 7 disk | 1004 |

Disassembly Tools Table 1001 (Concluded)

3. LP Compressor Rotor Blades Mass Moment Weigh

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 12 | P3C.1072869 | Adapter, stage 1 blade mass | |
| | | moment weight | 1005 |
| 13 | P3C.1072870 | Adapter, stage 2 blade mass moment weight | 1005 |
| 14 | P3C.1072871 | Adapter, stage 3 blade mass moment weight | 1005 |
| 1863 | PG.899201 | Adapter, balancing machine | 1005 |
| 24 | P3C.1073064 | Weights, counter balance, | |
| - - | | adapter (12) | 1005 |
| 25 | P3C.1073065 | Weights, counter balance, adapter (13) | 1005 |
| 26 | P3C.1073066 | Weights, counter balance, adapter (14) | 1006 |
| *1826 | PDJ.855908 | Screws, adapter (1863) | 1006 |
| 11 | P3C.1072868 | Adapter arm, adapter (12, 13 and 14), blade mass moment weight | 1006 |
| 33 | PG.1223021 | Graticule, mass moment weighing machine screen | 1006 |
| 1273 | P3C.867007 | Locator, adapter arm (1272), blade mass moment weight | 1006 |
| 1272 | P3C.867006 | Adapter arm, blade mass moment weight | 1006 |

Mass Moment Weigh Tools Table 1002

 $\begin{array}{c} \text{SPECIAL TOOLS ETC.} \\ \textbf{72-31-03} \\ \text{Page 1002} \\ \text{Aug 1/78} \end{array}$



4. LP Compressor Rotor Balancing Tools for Horizontal Balancing Procedure

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|--------------|
| 1675 | T.599772 | Protection guard, balancing | |
| 1025 | P3C.694319 | machine | 1007 |
| 600 | P3C.1089091 | Balance mandrel, stage 1 disk | 1007 |
| 379 | PJ.1083228 | Balance mandrel, stage 2 disk Balance mandrel, stage 3 disk | 1007 |
| 361 | P3C.1083224 | Balance mandrel, stage 4 disk | 1007 1007 |
| 362 | P3C.1083225 | Balance mandrel, stage 5 disk | 1007 |
| 602 | P3C.1089093 | Balance mandrel, stage 6 disk | 1008 |
| 1026 | P3C.694325 | Balancing mandrel, stage 7 disk | 1008 |
| 1275 | P3C.867022 | Retaining plate, mandrel (602), blade retaining | 1008 |
| 1154 | P3C.1259728 | Adjustable bearing, balancing machine | |
| 1303 | P3C.869283 | Protection guard, balancing machine | 1008 |
| 1500 | POJ.871100 | Protection guard, balancing machine | |
| 1641 | T.225614 | Setting gauge, adjustable bearing (1154) | 1009 |
| 1162 | PJ.857313 | Lifting fixture, balancing mandrels | 1009 |
| 1395 | P5H.1255631 | Container, stage 1 blades | 1009 |
| 1673 | T.441007 | Hydraclamp, balancing mandrels, part of 924 | |
| 1674 | T.599065 | Pedestal, balancing mandrel Hydraclamp (1673), part of 924 | 1009 1009 |
| 924 | P3C.1223173 | Stand, assembly/disassembly | 1009 |
| 1163 | PJ.857314 | Mounting plate, Hydraclamp (1673) balancing mandrels | 1009 |
| 1667 | P3C.599635 | Support stand, balancing mandrels | 1009 |
| 1184 | P3C.1229285 | Retaining bolt, balancing mandrels | 1010 |
| 401 | P3C.1083347 | Lifting fixture, stage 1 disk | 1001 |
| 1409 | P0868922 | Container, stage 1 disk | 1001 |
| 1165 | P3C.857324 | Mobile stand, LP disks/balancing mandrels | 1010 |
| 1123 | P3C.699967 | Protection/retaining band, stage 1 blades | 1010 |

Balancing Tools Table 1003 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 1185 1166 | P3C.857942 P3C.857325 | Extractor bolt, balancing mandrel Blade retainers, stage 1 and 2 | 1010 |
| *1326 | PJ.892824 | blades | 1010 |
| * 443 | P3C.1086775 | Support, disks | 1001 |
| *1410 | P3C.1086775 | Protector, stage 1-2 spacer ring Container, spacer rings | 1010 |
| *1396 | P5H.1255632 | Container, spacer rings Container, stage 2 blades | 1011 |
| *1407 | PO.868920 | Container, stage 2, 4, 5 and 6 | 1002 |
| | · | disks | 1002 |
| *1285 | P3C.867251 | Multiple leg sling, stage 2 disk | 1001 |
| * 366 | P3C.1083235 | Slave bolts, stage 2 disk/spacer securing | 1011 |
| * 364 | P3C.1083234 | Lifting fixture, stage 1-2 spacer | |
| *1124 | P3C.699968 | ring Protection/retaining band, | 1011 |
| 41165 | | stage 2 blades | 1011 |
| *1167 | P3C.857327 | Protector, stage 2-3 spacer ring | 1011 |
| *1397 | P5H.1255633 | Container, stage 3 blades | 1002 |
| *1408 | PO.868921 | Container, stage 3 disk | 1002 |
| *1217 | P3C.860141 | Multiple leg sling, stage 3-7 disks | 1002 |
| * 367 | P3C.1083237 | Slave bolts, stage 3 disk/spacer | 1002 |
| * 365 | P3C.1083236 | Lifting fixture, stage 2-3 spacer ring | 1011 |
| *1125 | P3C.699969 | Protection/retaining band, | 1011 |
| 1123 | 130.00000 | stage 3 blades | 1012 |
| . 1215 | P3C.860138 | Slave mandrel, blading, LP disks | 1012 |
| 874 | PJ.1229286 | Retaining bolt, slave mandrel | |
| *1655 | T.484702 | (1215) Hammer, blade keys, stages 3-7 | 1012 |
| 41.500 | | disks | 1012 |
| *1398 | P5H.1255634 | Container, stage 4 blades | 1003 |
| *1411 | PO.868924 | Container, spacer rings | 1012 |
| * 426 | P3C.1083378 | Slave bolt, stage 4 and 5 disk/ spacer | 1003 |
| * 444 | P3C.1086776 | Lifting fixture, stage 3-4 spacer ring | 1013 |
| *1126 | P3C.699970 | Protection/retaining band, stage 4 blades | |
| | | 4 DIGMES | 1013 |

Balancing Tools
Table 1003 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|--------------|--------------------------|--|--------------|
| *1168 | P3C.857328 | Protector, stage 3-4 spacer ring | 1013 |
| *1399 | P5H.1255635 | Container, stage 5 blades | 1003 |
| * 321 | P3C.1073269 | Multiple leg sling, stage 4-5, 5-6 and 6-7 spacer rings | 1013 |
| *1127 | P3C.699971 | Protection/retaining band, stage 5 blades | _ |
| *1169 | P3C.857329 | Protector stage 4-5 and 5-6 | 1013 |
| *1464 | P5H.1255636 | spacer rings | 1014 |
| * 368 | | Container, stage 6 blades | 1004 |
| | P3C.1083238 | Slave bolt, stage 6 disk/spacer | 1003 |
| *1128 | P3C.699972 | Protection/retaining band, stage 6 blades | 1014 |
| *1465 | P5H,1255637 | Container, stage 7 blades | 1014 |
| *1406 | PO.868919 | Container, stage 7 disk | _ |
| *1164 | P3C.857319 | Slave bolt, stage 7 disk/spacer | 1014 |
| *1129 | P3C.699973 | Protection/retaining band, stage 7 blades | |
| *1170 | P3C.857330 | Protector, stage 6-7 spacer ring | 1014 1014 |

Balancing Tools Table 1003 (Concluded)

5. LP Compressor Rotor Balancing Tools for Vertical Balancing Procedure

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| *1395 | P5H.1255631 | Container, stage 1 blades Balancing adapter, stage 1 Lifting fixture, stage 1 disk Container, stage 1 disk Screws, balancing adapters | 1001 |
| 1845 | PDJ.891315 | | 1015 |
| * 401 | P3C.1083347 | | 1001 |
| *1409 | PO.868922 | | 1001 |
| *1826 | PDJ.855908 | | 1006 |

Balancing Tools
Table 1004 (Continued)

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| *1326 PJ.892824 Support, disks 100 *1410 P3C.868923 Container, spacer rings 100 *14396 P5H.1255632 Container, stage 1-2 spacer ring 100 *1407 P0.868920 Container, stage 2 blades 100 *1285 P3C.867251 Multiple leg sling, stage 2 disk 100 *1286 P3C.1083235 Slave bolts, stage 2 disk/spacer securing 100 *1124 P3C.699968 Protection/retaining band, stage 2 blades 100 *1846 PDJ.891316 Balancing adapter, stage 2 loades 100 *1849 PDJ.1068994 Hub, adapter 1846 100 *1849 PDJ.1061319 Location pins, adapter 1846 100 *1849 PDJ.1061319 Location pins, adapter 1846 100 *1840 P3C.1083234 Lifting fixture, stage 1-2 spacer ring 100 *1397 P5H.1255633 Container, stage 2-3 spacer ring 100 *1217 P3C.857327 Protector, stage 2-3 spacer ring 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 100 *1227 P3C.860141 Slave bolts, stage 3 disk/spacer 100 *1125 P3C.699969 Protection/retaining band, stage 3 blades 100 *1847 PDJ.891317 Balancing adapter 100 *1655 T.484702 Hammer, blade keys, stage 3-7 disks 100 *1398 P5H.1255634 Container, stage 4 blades 100 *1411 P0.868924 Container, stage 4 blades 100 *1421 P3C.699970 Protection/retaining band, stage 4 blades 100 *1852 PDJ.1067563 Hub, adapter 1852 100 *1850 PDJ.1067564 Location pin, stage 4 *100 *100 *100 *100 *100 *100 *100 *10 | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---|-----------------|--------------------------|---------------------------------------|------|
| *1326 PJ.892824 Support, disks 100 *1410 P3C.868923 Container, spacer rings 100 *14396 P5H.1255632 Container, stage 1-2 spacer ring 100 *1407 P0.868920 Container, stage 2 blades 100 *1285 P3C.867251 Multiple leg sling, stage 2 disk 100 *1286 P3C.1083235 Slave bolts, stage 2 disk/spacer securing 100 *1124 P3C.699968 Protection/retaining band, stage 2 blades 100 *1846 PDJ.891316 Balancing adapter, stage 2 loades 100 *1849 PDJ.1068994 Hub, adapter 1846 100 *1849 PDJ.1061319 Location pins, adapter 1846 100 *1849 PDJ.1061319 Location pins, adapter 1846 100 *1840 P3C.1083234 Lifting fixture, stage 1-2 spacer ring 100 *1397 P5H.1255633 Container, stage 2-3 spacer ring 100 *1217 P3C.857327 Protector, stage 2-3 spacer ring 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 100 *1227 P3C.860141 Slave bolts, stage 3 disk/spacer 100 *1125 P3C.699969 Protection/retaining band, stage 3 blades 100 *1847 PDJ.891317 Balancing adapter 100 *1655 T.484702 Hammer, blade keys, stage 3-7 disks 100 *1398 P5H.1255634 Container, stage 4 blades 100 *1411 P0.868924 Container, stage 4 blades 100 *1421 P3C.699970 Protection/retaining band, stage 4 blades 100 *1852 PDJ.1067563 Hub, adapter 1852 100 *1850 PDJ.1067564 Location pin, stage 4 *100 *100 *100 *100 *100 *100 *100 *10 | 1123 | P3C.699967 | Protection/retaining band, | |
| *1410 P3C.868923 Container, spacer rings 10 * 443 P3C.1086775 Protector, stage 1-2 spacer ring 10 * 1396 P5H.1255632 Container, stage 2 blades * 100 * 1124 P3C.699968 Protection/retaining band, stage 2 blades * 100 * 1846 PDJ.891316 Balancing adapter, stage 2 long 10 * 1850 PDJ.1061319 Location pins, adapter 1846 long 1849 PDJ.1061319 Location pins, adapter 1846 long 1849 PDJ.1061319 Location pins, adapter 1846 long 1849 PSJ.1083234 Lifting fixture, stage 1-2 spacer ring * 1127 P3C.857327 Protector, stage 2-3 spacer ring * 1287 P5H.1255633 Container, stage 3 blades * 1287 P3C.860141 Multiple leg sling, stage 3-7 disks * 367 P3C.1083237 Slave bolts, stage 3 disk/spacer location pins, adapter lase 10 * 1847 PDJ.891317 Balancing adapter * 1848 P5H.1255634 Container, stage 3 disk/spacer ring * 10 * 1847 PDJ.891317 Balancing adapter * 10 * 1850 P3C.1083236 Lifting fixture, stage 2-3 spacer ring * 10 * 1847 PDJ.891317 Balancing adapter * 10 * 1859 P3C.1083236 Lifting fixture, stage 3-7 disks * 1849 P5H.1255634 Container, stage 4 blades * 10 * 1850 PDJ.1067563 Balancing adapter, stage 3-7 disks * 10 * 1256 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 10 * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 1266 P3C.699970 Protection/retaining band, stage 4 blades * 1267 P3C.699970 Protection/retaining band, stage 4 blades * 1268 P3C.699970 P1C.607564 | | | | 1010 |
| # 443 | | | | 1001 |
| #1396 P5H.1255632 Container, stage 2 blades #1407 PO.868920 Container, stage 2, 4, 5 and 6 disks #1285 P3C.867251 Multiple leg sling, stage 2 disk 100 #1366 P3C.1083235 Slave bolts, stage 2 disk/spacer securing 10 #1124 P3C.699968 Protection/retaining band, stage 2 blades 10 1846 PDJ.891316 Balancing adapter, stage 2 10 1850 PDJ.1068994 Hub, adapter 1846 10 1849 PDJ.1061319 Location pins, adapter 1846 10 #1364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring P7C.857327 Protector, stage 2-3 spacer ring 10 #1397 P5H.1255633 Container, stage 3 blades 100 #1408 PO.868921 Container, stage 3 disk 100 #1217 P3C.860141 Multiple leg sling, stage 3-7 disks #1217 P3C.860141 Multiple leg sling, stage 3-7 disks #1217 P3C.1083237 Slave bolts, stage 3 disk/spacer 100 #1125 P3C.699969 Protection/retaining band, stage 3 blades 10 #1847 PDJ.891317 Balancing adapter 10 #1655 T.484702 Hammer, blade keys, stage 3-7 disks #1398 P5H.1255634 Container, stage 4 blades 100 #1411 PO.868924 Container, stage 4 blades 100 #1421 P3C.699970 Protection/retaining band, stage 4 blades 100 #1421 P3C.699970 Protection/retaining band, stage 4 blades 100 #1439 PDJ.1067563 Hub, adapter 1852 100 1850 PDJ.1067564 Location pin, stage 4 Lifting fixture, stage 3-4 | | | | 1013 |
| #1407 PO.868920 Container, stage 2, 4, 5 and 6 disks #1285 P3C.867251 Multiple leg sling, stage 2 disk 100 | | | | 1010 |
| disks 100 | | | | 1002 |
| *366 P3C.1083235 Slave bolts, stage 2 disk/spacer securing Protection/retaining band, stage 2 blades 10 1846 PDJ.891316 Balancing adapter, stage 2 10 1850 PDJ.1068994 Hub, adapter 1846 10 1849 PDJ.1061319 Location pins, adapter 1846 10 *364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring 10 *1167 P3C.857327 Protector, stage 2-3 spacer ring 10 *1397 P5H.1255633 Container, stage 3 blades 100 *1408 P0.868921 Container, stage 3 disk 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks *367 P3C.1083237 Slave bolts, stage 3 disk/spacer Protection/retaining band, stage 3 blades 10 *1125 P3C.699969 Protection/retaining band, stage 3 blades 10 *1847 PDJ.891317 Balancing adapter 10 *365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 *1655 T.484702 Hammer, blade keys, stage 3-7 disks *1398 P5H.1255634 Container, stage 4 blades 100 *1411 P0.868924 Container, spacer rings 100 *1126 P3C.699970 Protection/retaining band, stage 4 blades 100 *1850 PDJ.1067563 Hub, adapter 1852 Balancing adapter, stages 4, 5 and 6 100 1860 PDJ.1067564 Location pin, stage 4 100 *4444 P3C.1086776 Lifting fixture, stage 3-4 | 1407 | PO.868920 | · · · · · · · · · · · · · · · · · · · | 1002 |
| *366 P3C.1083235 Slave bolts, stage 2 disk/spacer securing Protection/retaining band, stage 2 blades 10 1846 PDJ.891316 Balancing adapter, stage 2 10 1850 PDJ.1068994 Hub, adapter 1846 10 1849 PDJ.1061319 Location pins, adapter 1846 10 *364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring 10 *1167 P3C.857327 Protector, stage 2-3 spacer ring 10 *1397 P5H.1255633 Container, stage 3 blades 100 *1408 P0.868921 Container, stage 3 disk 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks *367 P3C.1083237 Slave bolts, stage 3 disk/spacer Protection/retaining band, stage 3 blades 10 *1125 P3C.699969 Protection/retaining band, stage 3 blades 10 *1847 PDJ.891317 Balancing adapter 10 *365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 *1655 T.484702 Hammer, blade keys, stage 3-7 disks *1398 P5H.1255634 Container, stage 4 blades 100 *1411 P0.868924 Container, spacer rings 100 *1126 P3C.699970 Protection/retaining band, stage 4 blades 100 *1850 PDJ.1067563 Hub, adapter 1852 Balancing adapter, stages 4, 5 and 6 100 1860 PDJ.1067564 Location pin, stage 4 100 *4444 P3C.1086776 Lifting fixture, stage 3-4 | 1285 | P3C.867251 | Multiple leg sling, stage 2 disk | 1001 |
| #1124 P3C.699968 Protection/retaining band, stage 2 blades 10 1846 PDJ.891316 Balancing adapter, stage 2 10 1849 PDJ.1068994 Hub, adapter 1846 10 1849 PDJ.1061319 Location pins, adapter 1846 10 1849 P3C.1083234 Lifting fixture, stage 1-2 spacer ring 10 18167 P3C.857327 Protector, stage 2-3 spacer ring 10 181397 P5H.1255633 Container, stage 3 blades 100 1840 P0.868921 Container, stage 3 disk 100 1841 P3C.860141 Multiple leg sling, stage 3-7 disks 100 1847 P3C.860141 Multiple leg sling, stage 3-7 disks 100 1847 PDJ.891317 Balancing adapter 10 1847 PDJ.891317 Balancing adapter 10 1855 T.484702 Hammer, blade keys, stage 3-7 disks 100 18411 P0.868924 Container, stage 4 blades 100 18411 P0.868924 Container, stage 4 blades 100 18411 P0.868924 Container, spacer rings 100 18411 P0.868924 Container, spacer rings 100 1852 PDJ.1067563 Hub, adapter 1852 100 1852 PDJ.1067564 Balancing adapter, stages 4, 5 and 6 100 1860 PDJ.1067564 Lifting fixture, stage 4 100 1860 PDJ.1067564 Lifting fixture, stage 3-4 | 366 | P3C.1083235 | Slave bolts, stage 2 disk/spacer | 1011 |
| 1846 PDJ.891316 Balancing adapter, stage 2 10 1850 PDJ.1068994 Hub, adapter 1846 10 1849 PDJ.1061319 Location pins, adapter 1846 10 * 364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring *1167 P3C.857327 Protector, stage 2-3 spacer ring 10 *1397 P5H.1255633 Container, stage 3 blades 100 *1408 PO.868921 Container, stage 3 disk 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 100 *1217 P3C.699969 Protection/retaining band, stage 3 blades 100 *1125 P3C.699969 Protection/retaining band, stage 3 blades 10 1847 PDJ.891317 Balancing adapter 10 * 365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 * 1655 T.484702 Hammer, blade keys, stage 3-7 disks 10 *1398 P5H.1255634 Container, stage 4 blades 10 * 1411 PO.868924 Container, spacer rings 10 * 1126 P3C.699970 Protection/retaining band, stage 4 blades 10 * 1860 PDJ.1067563 Hub, adapter 1852 10 1860 PDJ.1067564 Location pin, stage 4 10 * 444 P3C.1086776 Lifting fixture, stage 3-4 | 1124 | P3C.699968 | Protection/retaining band, | 1011 |
| 1850 PDJ.1068994 Hub, adapter 1846 10 1849 PDJ.1061319 Location pins, adapter 1846 10 * 364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring *1167 P3C.857327 Protector, stage 2-3 spacer ring 10 *1397 P5H.1255633 Container, stage 3 blades 100 *1408 PO.868921 Container, stage 3 disk 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 100 *1217 P3C.699969 Protection/retaining band, stage 3 blades 100 *1125 P3C.699969 Protection/retaining band, stage 3 blades 100 1847 PDJ.891317 Balancing adapter 100 *365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 100 *1655 T.484702 Hammer, blade keys, stage 3-7 disks 100 *1398 P5H.1255634 Container, stage 4 blades 100 *1411 PO.868924 Container, spacer rings 100 *1126 P3C.699970 Protection/retaining band, stage 4 blades 100 *1126 PDJ.1067563 Hub, adapter 1852 100 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 100 1860 PDJ.1067564 Location pin, stage 4 100 *444 P3C.1086776 Lifting fixture, stage 3-4 | 1846 | PD.T. 891316 | | 1015 |
| 1849 PDJ.1061319 Location pins, adapter 1846 10 * 364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring 10 *1167 P3C.857327 Protector, stage 2-3 spacer ring 10 *1397 P5H.1255633 Container, stage 3 blades 106 *1408 P0.868921 Container, stage 3 disk 106 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 106 * 367 P3C.1083237 Slave bolts, stage 3 disk/spacer 106 * 1125 P3C.699969 Protection/retaining band, stage 3 blades 10 1847 PDJ.891317 Balancing adapter 10 * 365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 * 1655 T.484702 Hammer, blade keys, stage 3-7 disks 10 * 1398 P5H.1255634 Container, stage 4 blades 106 * 1411 P0.868924 Container, spacer rings 10 * 1126 P3C.699970 Protection/retaining band, stage 4 blades 106 * 1860 PDJ.1067563 Hub, adapter 1852 10 1860 PDJ.1067564 Location pin, stage 4 10 * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | | 1015 |
| # 364 P3C.1083234 Lifting fixture, stage 1-2 spacer ring | | | · · · · · · · · · · · · · · · · · · · | 1019 |
| *1167 P3C.857327 Protector, stage 2-3 spacer ring 10 *1397 P5H.1255633 Container, stage 3 blades 106 *1408 P0.868921 Container, stage 3 disk 106 *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 106 *367 P3C.1083237 Slave bolts, stage 3 disk/spacer 106 *1125 P3C.699969 Protection/retaining band, stage 3 blades 10 1847 PDJ.891317 Balancing adapter 10 *365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 *1655 T.484702 Hammer, blade keys, stage 3-7 disks 10 *1398 P5H.1255634 Container, stage 4 blades 106 *1411 P0.868924 Container, spacer rings 10 *1126 P3C.699970 Protection/retaining band, stage 4 blades 106 *1126 PDJ.1067563 Hub, adapter 1852 10 1852 PDJ.1067564 Location pin, stage 4 106 1860 PDJ.1067564 Location pin, stage 4 106 *444 P3C.1086776 Lifting fixture, stage 3-4 | | - | Lifting fixture, stage 1-2 spacer | |
| *1397 P5H.1255633 Container, stage 3 blades 100 *1408 P0.868921 Container, stage 3 disk 100 *1217 P3C.860141 Multiple leg sling, stage 3-7 | 1167 | P3C 857327 | | 101 |
| *1408 | _ | | | 1002 |
| *1217 P3C.860141 Multiple leg sling, stage 3-7 disks 106 * 367 P3C.1083237 Slave bolts, stage 3 disk/spacer 106 *1125 P3C.699969 Protection/retaining band, stage 3 blades 10 1847 PDJ.891317 Balancing adapter 10 * 365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 * 1655 T.484702 Hammer, blade keys, stage 3-7 disks 10 * 1398 P5H.1255634 Container, stage 4 blades 106 * 1411 P0.868924 Container, spacer rings 10 * 1126 P3C.699970 Protection/retaining band, stage 4 blades 10 209 PDJ.1067563 Hub, adapter 1852 10 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 10 1860 PDJ.1067564 Location pin, stage 4 * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | | 100 |
| * 367 P3C.1083237 Slave bolts, stage 3 disk/spacer 106 *1125 P3C.699969 Protection/retaining band, | - | | Multiple leg sling, stage 3-7 | 1002 |
| *1125 P3C.699969 Protection/retaining band, stage 3 blades 10 1847 PDJ.891317 Balancing adapter 10 * 365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10 *1655 T.484702 Hammer, blade keys, stage 3-7 disks 10 *1398 P5H.1255634 Container, stage 4 blades 100 *1411 PO.868924 Container, spacer rings 10 *1126 P3C.699970 Protection/retaining band, stage 4 blades 10 *209 PDJ.1067563 Hub, adapter 1852 10 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 10 1860 PDJ.1067564 Location pin, stage 4 10 * 444 P3C.1086776 Lifting fixture, stage 3-4 | 367 | P3C 1083237 | | 1002 |
| 1847 PDJ.891317 Balancing adapter * 365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring *1655 T.484702 Hammer, blade keys, stage 3-7 disks *1398 P5H.1255634 Container, stage 4 blades *1411 PO.868924 Container, spacer rings *1126 P3C.699970 Protection/retaining band, stage 4 blades 209 PDJ.1067563 Hub, adapter 1852 109 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 1860 PDJ.1067564 Location pin, stage 4 * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | Protection/retaining band, | |
| * 365 P3C.1083236 Lifting fixture, stage 2-3 spacer ring 10. *1655 T.484702 Hammer, blade keys, stage 3-7 disks 10. *1398 P5H.1255634 Container, stage 4 blades 10. *1411 P0.868924 Container, spacer rings 10. *1126 P3C.699970 Protection/retaining band, stage 4 blades 10. 209 PDJ.1067563 Hub, adapter 1852 10. 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 10. 1860 PDJ.1067564 Location pin, stage 4 10. * 444 P3C.1086776 Lifting fixture, stage 3-4 | 1847 | DD.T 801317 | | |
| *1655 T.484702 Hammer, blade keys, stage 3-7 disks 10 *1398 P5H.1255634 Container, stage 4 blades 106 *1411 PO.868924 Container, spacer rings 10 *1126 P3C.699970 Protection/retaining band, stage 4 blades 10 209 PDJ.1067563 Hub, adapter 1852 10 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 10 1860 PDJ.1067564 Location pin, stage 4 10 * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | Lifting fixture, stage 2-3 spacer | |
| *1398 P5H.1255634 Container, stage 4 blades 106 *1411 PO.868924 Container, spacer rings 108 *1126 P3C.699970 Protection/retaining band, stage 4 blades 108 209 PDJ.1067563 Hub, adapter 1852 10852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 108 1860 PDJ.1067564 Location pin, stage 4 108 * 444 P3C.1086776 Lifting fixture, stage 3-4 | 1655 | T.484702 | Hammer, blade keys, stage 3-7 | |
| *1411 PO.868924 Container, spacer rings 10. *1126 P3C.699970 Protection/retaining band, | +1 200 | DEM 1055604 | | |
| *1126 P3C.699970 Protection/retaining band, stage 4 blades 10. 209 PDJ.1067563 Hub, adapter 1852 10. 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 10. 1860 PDJ.1067564 Location pin, stage 4 10. * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | | |
| 209 PDJ.1067563 Hub, adapter 1852 10. 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 10. 1860 PDJ.1067564 Location pin, stage 4 10. * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | Protection/retaining band, | |
| 1852 PDJ.1067306 Balancing adapter, stages 4, 5 and 6 100 1860 PDJ.1067564 Location pin, stage 4 100 * 444 P3C.1086776 Lifting fixture, stage 3-4 | 300 | DDT 1067563 | | 1013 |
| and 6 103 1860 PDJ.1067564 Location pin, stage 4 103 * 444 P3C.1086776 Lifting fixture, stage 3-4 | | | | 1016 |
| 1860 PDJ.1067564 Location pin, stage 4 103 * 444 P3C.1086776 Lifting fixture, stage 3-4 | 1032 | EDM TOB/300 | | 101 |
| * 444 P3C.1086776 Lifting fixture, stage 3-4 | 1960 | DDT 1067564 | | 1016 |
| * | | | | TOT |
| spacer ring 10 | * *** | ± 3C+TO00110 | | 1013 |

Balancing Tools Table 1004 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| 1168 | P3C.857328 | Protector, stage 3-4 spacer ring | 1013 |
| 426 | P3C.1083378 | Slave bolt, stage 4 and 5 disk/ spacer securing | 1003 |
| 1399 | P5H.1255635 | Container, stage 5 blades | 1003 |
| 1127 | P3C.699971 | Protection/retaining band, stage 5 | |
| | | blades | 1013 |
| 321 | P3C.1073269 | Multiple leg sling, stage 4-5, | |
| | | 5-6 and 6-7 spacer ring | 1013 |
| 1169 | P3C.857329 | Protector stage 4-5 and 5-6 | |
| | | spacer rings | 1014 |
| 1464 | P5H.1255636 | Container stage 6 blades | 1004 |
| 368 | P3C.1083238 | Slave bolt, stage 6 disk/spacer | 1003 |
| 1128 | P3C.699972 | Protection/retaining band | |
| | | stage 6 blades | 1014 |
| 1859 | PDJ.1067327 | Location pin, stage 6 | 1006 |
| 1465 | P5H.1255637 | Container, stage 7 blades | 1014 |
| 1406 | P0.868919 | Container, stage 7 disk | 1014 |
| :1164 | P3C.857319 | Slave boit, stage 7 disk/spacer | 1014 |
| 1129 | P3C.699973 | Protection/retaining band, | |
| | | stage 7 blades | 1014 |
| 1856 | PDJ.891321 | Balancing adapter stage 7 | 1006 |
| :1170 | P3C.857330 | Protector, stage 6-7 spacer ring | 1014 |

Balancing Tools Table 1004 (Concluded)

6. LP Compressor Rotor Tools for Inspection/Check.

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--------------------------------------|------|
| 3142 | \$3\$20002000 | Inspection Fixture, stage 1-4 blades | 1017 |

Inspection/Check Tools Table 1005

SPECIAL TOOLS ETC.

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7. LP Compressor Rotor Tools for In-situ Blade Blending

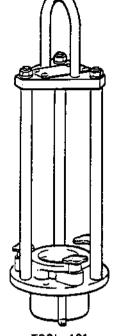
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---------------------------------|-------------|
| *3146 | S3S20282000 | Kit, Blade Blending | 1018 |
| *3169 | \$3\$20592000 | Training Aid, Blade Blending | 1018 |

In-situ Blade Blending Tools Table 1006

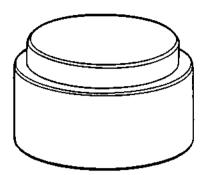
SPECIAL TOOLS ETC.

Page 1008 Jun 30/01 Printed in England

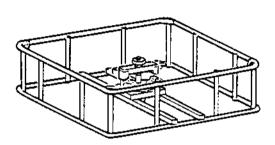




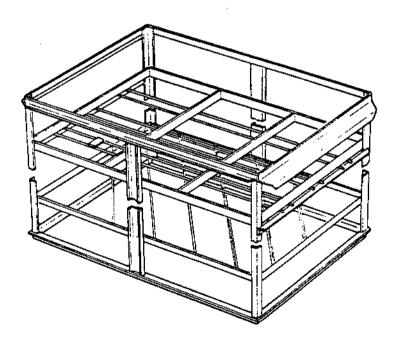
TOOL 401 17.00 X 5.00 IN DIA (435 X 130 MM)



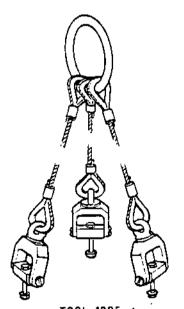
TOOL 1326 3.25 X 5.50 IN DIA (85 X 140 MM)



TOOL 1409 15.75 X 15.75 X 6.00 IN (400 X 400 X 155 MM)



TOOL 1395 23.00 X 21.50 X 16.00 IN (585 X 550 X 410 MM)



TOOL 1285 23.50 X 10.25 IN DIA (600 X 260 MM)

LP Compressor Rotor - Special Tools Figure 1001

SPECIAL TOOLS ETC.

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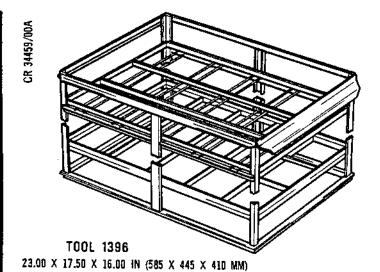
72-31-03
Page 1008B
Dec 1/97

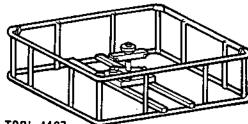


OLYMPUS 593

MK.610-14-28 OVERHAUL

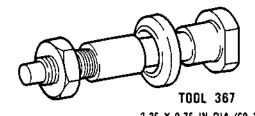




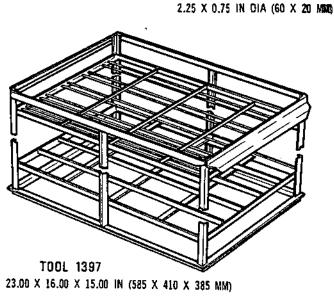


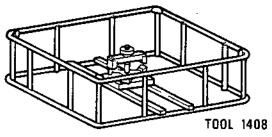
TOOL 1407

21.75 X 21.75 X 5.25 IN (555 X 555 X 135 MM)



TOOL 1217
25.25 X 15.25 IN DIA (645 X 390 MM)





20.75 X 20.75 X 5.50 IN (530 X 530 X 140 MM)

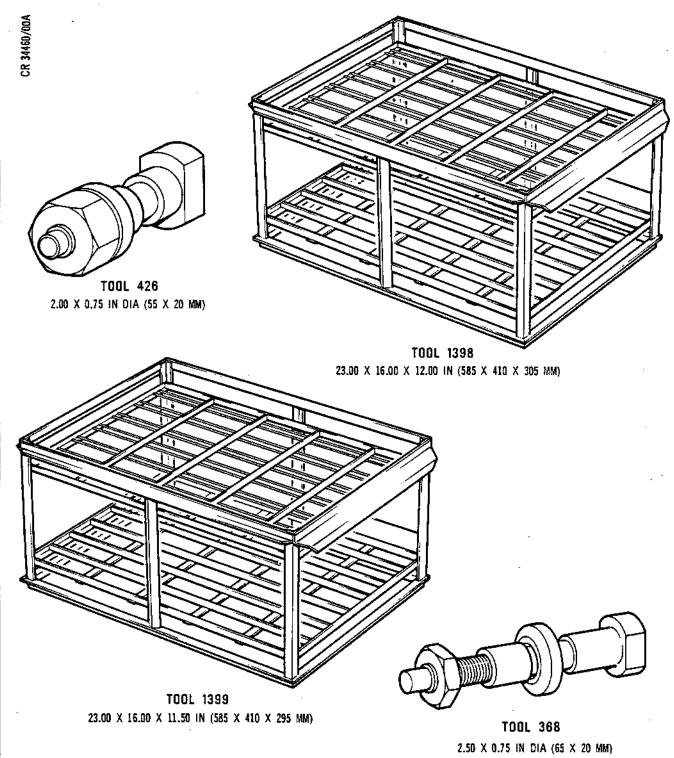
LP Compressor Rotor - Special Tools Figure 1002

SPECIAL TOOLS ETC.

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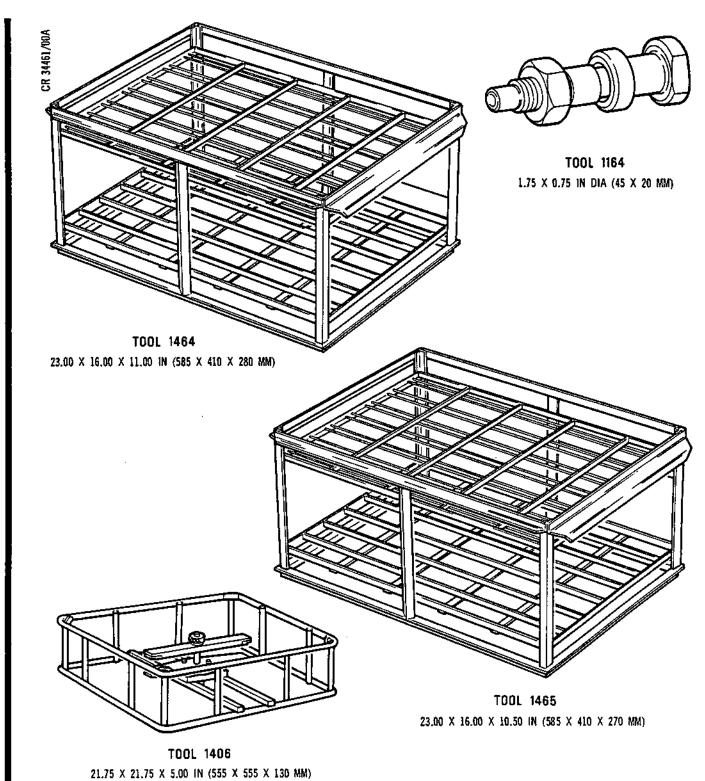
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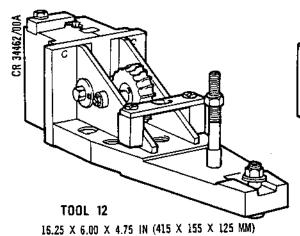
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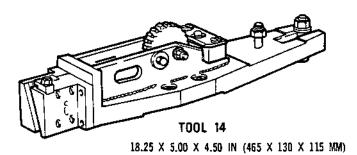
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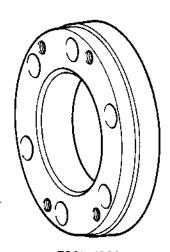




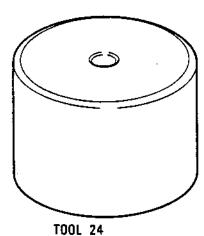
T00L 13

17.50 X 5.00 X 4.75 IN (445 X 130 X 125 MM)

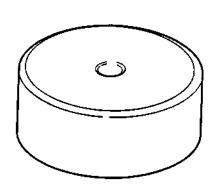




TOOL 1863 1.25 X 5.00 IN DIA (35 X 130 MM)



3.00 X 4.00 IN DIA (80 X 105 MM)

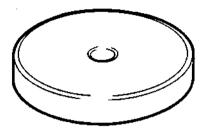


TOOL 25 1.75 X 4.00 IN DIA (45 X 105 MM)

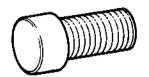
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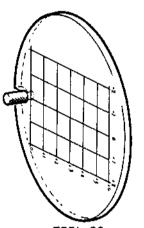
TOOL 26 0.75 X 4.00 IN DIA (20 X 105 MM)



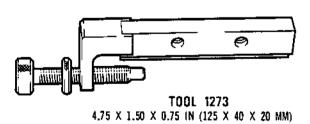
TOOL 1826 0.75 X 1.50 IN DIA (20 X 40 MM)

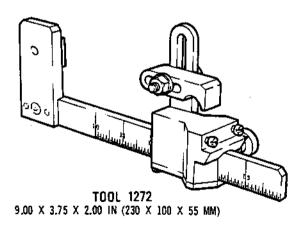


TOOL 11 13.25 X 1.75 X 1.50 IN (340 X 45 X 40 MM)



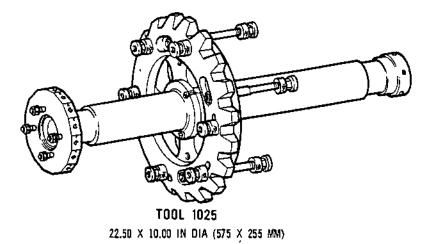
TOOL 33 1.00 X 6.50 IN DIA (30 X 165 MM)





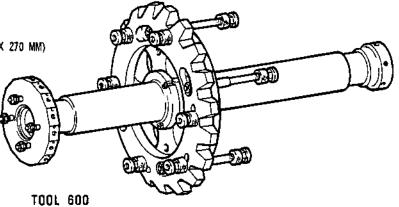
LP Compressor Rotor - Special Tools Figure 1006

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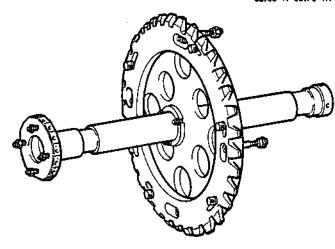


TOOL 1675

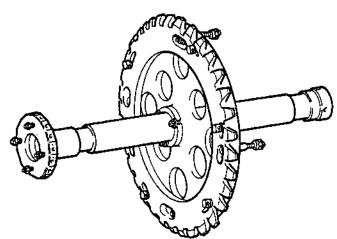
55.75 X 54.00 X 10.50 IN (1420 X 1375 X 270 MM)



22.50 X 12.75 IN DIA (575 X 325 MM)



TOOL 379 25.00 X 16.00 IN DIA (635 X 410 MM)



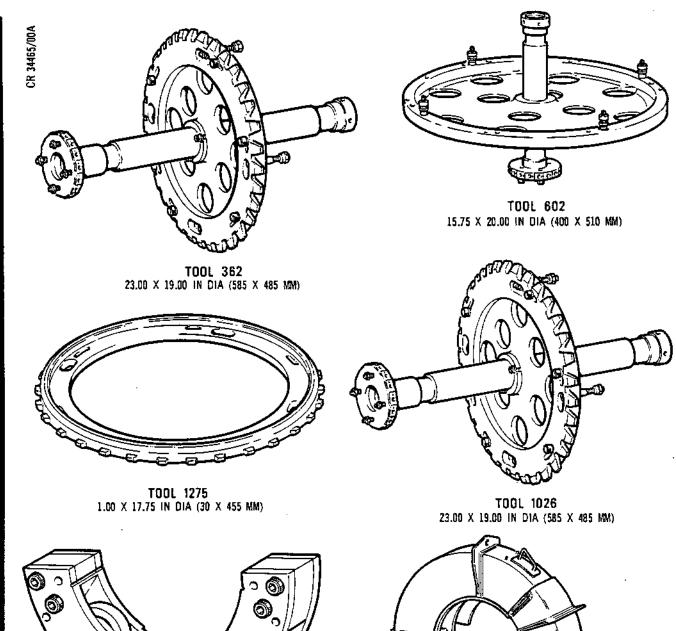
TOOL 361 23.00 X 19.00 IN DIA (585 X 485 MM)

LP Compressor Rotor - Special Tools Figure 1007

SPECIAL TOOLS ETC

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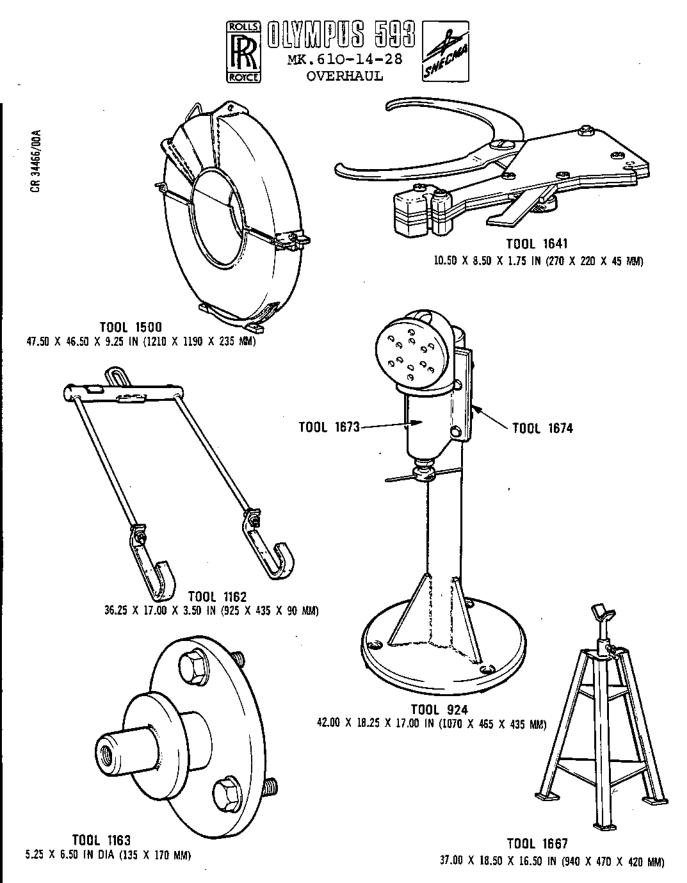


TOOL 1154 10.00 X 5.00 X 3.00 IN (255 X 130 X 80 MM)

SPECIAL TOOLS ETC.

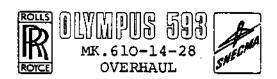
TOOL 1303 51.50 X 53.50 X 16.50 IN (1310 X 1360 X 420 MM)

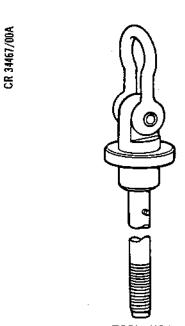
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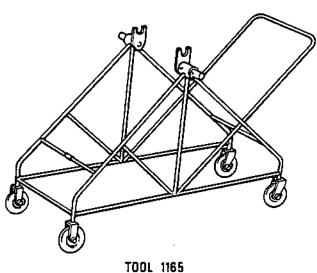
SPECIAL TOOLS ETC.

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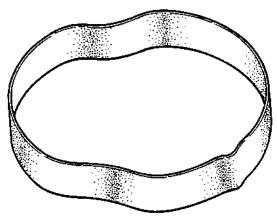




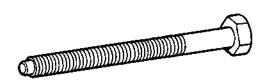
TOOL 1184 26.00 X 3.00 X 2.25 IN DIA (660 X 80 X 60 MM DIA)



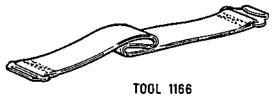
60.50 X 41.25 X 34.50 IN (1540 X 1050 X 880 MM)



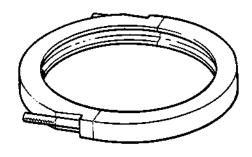
TOOL 1123 6.00 X 42.00 IN DIA (155 X 1070 MM DIA)



TOOL 1185 5.25 X 1.00 IN DIA (135 X 25 MM DIA)



12.00 X 1.25 IN DIA (305 X 35 MM DIA)



TOOL 443 14.00 X 14.00 X 1.50 IN (355 X 355 X 40 MM)

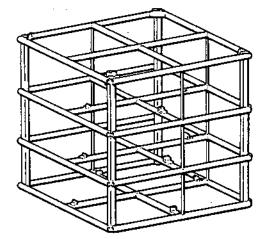
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OMMPUS 598

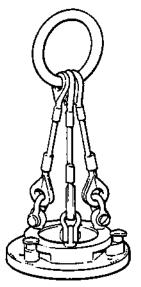
MK.610-14-28 OVERHAUL



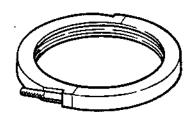


CR 34468/00A

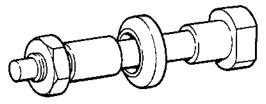
TOOL 1410 20.00 X 20.00 X 19.25 N (510 X 510 X 490 MM)



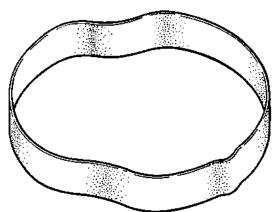
TOOL 364 18.00 X 8.00 IN DIA (450 X 205 MM DIA)



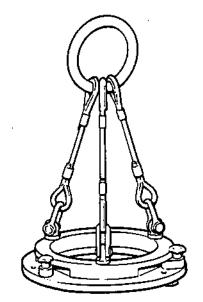
TOOL 1167 17.75 X 1.50 IN DIA (455 X 40 MM)



TOOL 366 2.50 X 0.75 IN DIA (65 X 20 MM DIA)



TOOL 1124 5.00 X 40.00 IN DIA (130 X 1020 MM DIA)



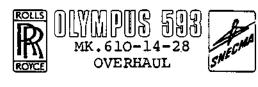
TOOL 365 17.50 X 11.00 (N DIA (445 X 280 MM))

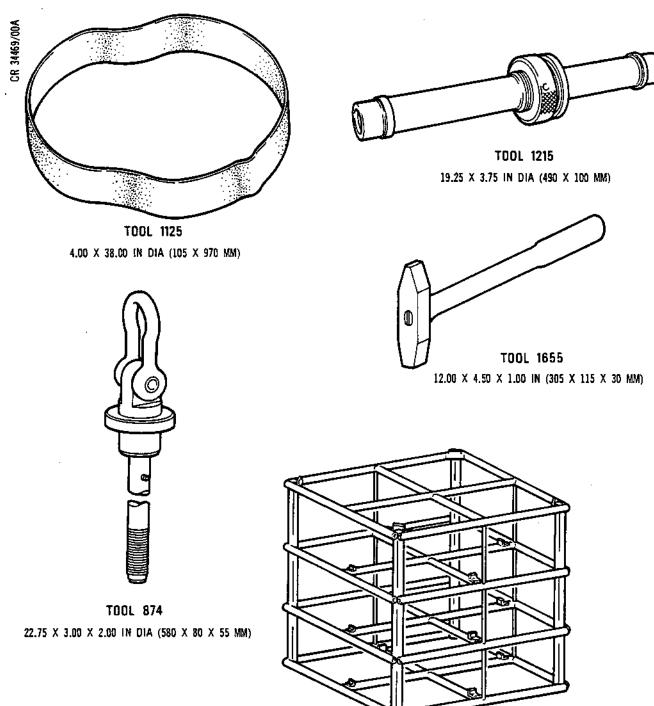
LP Compressor Rotor - Special Tools Figure 1011

SPECIAL TOOLS ETC.

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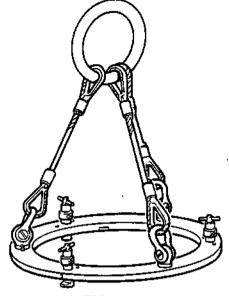
TOOL 1411 20.00 X 20.00 X 18.50 IN (510 X 510 X 470 MM)

LP Compressor Rotor - Special Tools Figure 1012

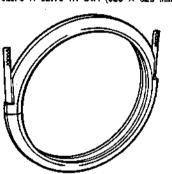
SPECIAL TOOLS ETC.

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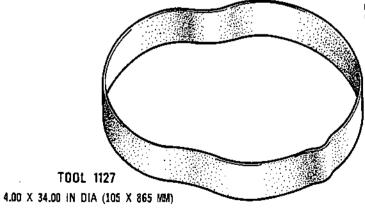




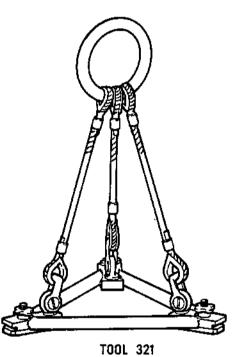
TOOL 444 12.75 X 12.75 IN DIA (325 X 325 MM)



TOOL 1168 21.00 X 1.50 IN (535 X 40 MM)



TOOL 1128 4.00 X 36.00 IN DIA (105 X 915 MM)



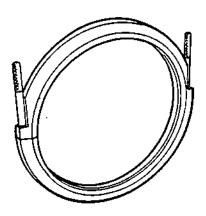
19.75 X 14.00 X 12.25 IN (505 X 360 X 315 MM)

LP Compressor Rotor - Special Tools Figure 1013

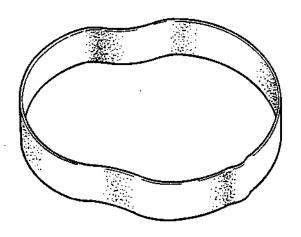
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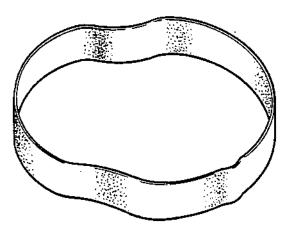
CR 34471/00A



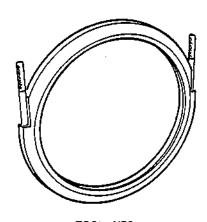
TOOL 1169 21.00 X 1.50 IN (535 X 40 MM)



TOOL 1128 4.00 X 32.00 IN DIA (105 X 815 MM)



TOOL 1129 4.00 X 30.00 IN DIA (105 X 765 MM)



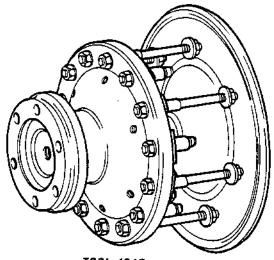
TOOL 1170 21.00 X 1.50 IN (535 X 40 MM)

LP Compressor Rotor - Special Tools Figure 1014

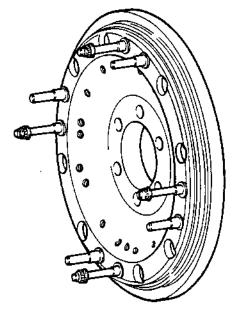
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MK.610-14-2: OVERHAUL

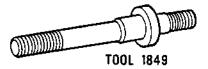


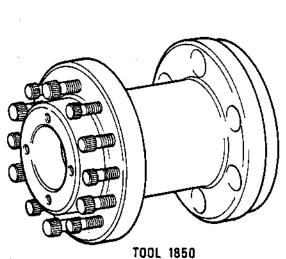


TOOL 1845 8.25 X 10.50 IN DIA (210 X 270 MM)

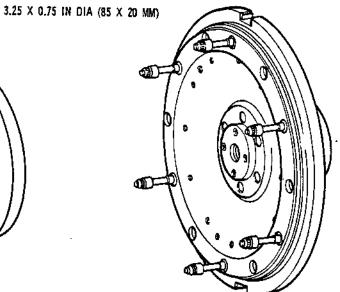


TOOL 1846 4.25 X 12.75 IN DIA (110 X 325 MM)





6.00 X 5.00 IN DIA (155 X 130 MM)



TOOL 1847 7.75 X 15.75 IN DIA (200 X 405 MM)

LP Compressor Rotor - Special Tools Figure 1015

SPECIAL TOOLS ETC.

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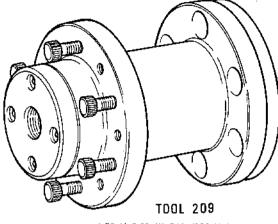
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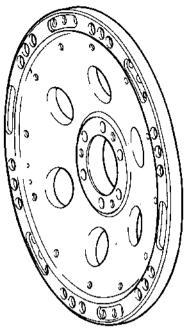
MK.610-14-28 OVERHAUL



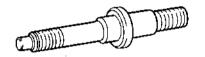
CR 34473/00A



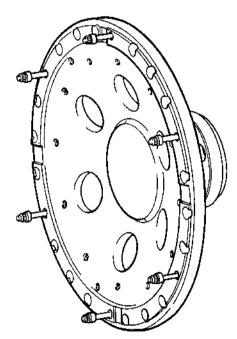
4.75 X 5.00 IN DIA (125 X 130 MM)



TOOL 1852 2.00 X 16.00 IN DIA (55 X 410 MM)



TOOL 1860 3.00 X 0.75 IN DIA (80 X 20 MM)



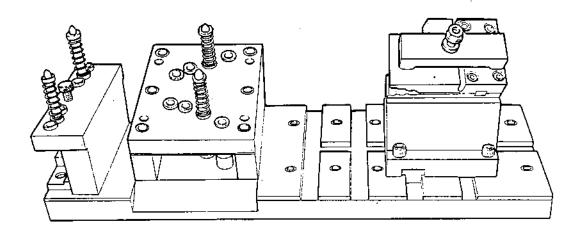
TOOL 1856 7.25 X 16.25 IN DIA (185 X 415 MM)

TOOL 1859

3.25 X 0.75 IN DIA (85 X 20 MM)

LP Compressor Rotor - Special Tools Figure 1016

SPECIAL TOOLS ETC. -31-03 Page 1023 Aug 1/78



TOOL 3142

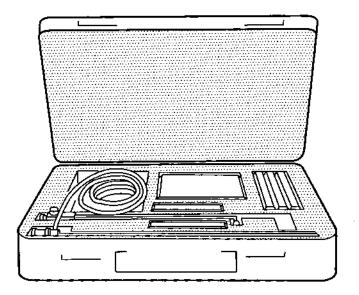
23.75 × 16.25 × 10 IN (603 × 412 × 254 MM)

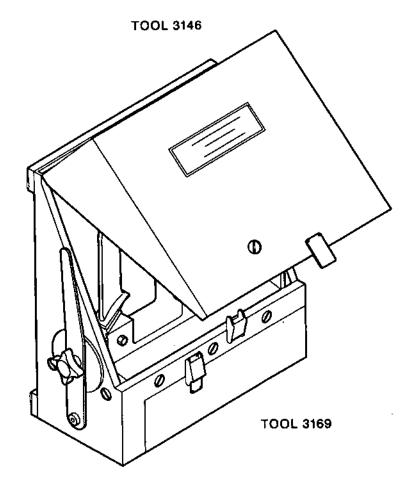
LP Compressor Rotor - Special Tools Figure 1017

SPECIAL TOOLS ETC.

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LP Compressor Rotor - Special Tools Figure 1018

SPECIAL TOOLS ETC.

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LP COMPRESSOR DRIVE SHAFT - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

General

- A. The special tools, fixtures and equipment listed in Table 1001, 1002, 1003 and 1004 are those required to disassemble, assemble and balance the L.P. drive shaft, and to set the LP signal system.
- B. The tools have been listed in order of usage, and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. LP Drive Shaft Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| * 408 | P3C.1083354 | Protector, LP drive shaft rear splines | 1001 |
| * 1055 | P3C.695737 | Lifting fixture, LP drive shaft rear | 1001 |
| * 999 | PJ.1234583 | Protector, LP drive shaft front splines/labyrinth | 1001 |
| * 1110 | P3C.699948 | Build/strip stand, LP drive shaft | 1001 |
| * 1305 | P3C.871919 | Mechanical puller, LP drive shaft sleeve removal | 1001 |
| 1451 | POJ.868977 | Fixture, LP drive shaft rear | 1002 |
| 655 | P5J.1294453 | Mechanical puller, stiffener disk assembly removal | 1002 |
| * 1109 | P3C.699947 | Lifting fixture, LP drive shaft front | 1002 |
| * 328 | P3C.1073289 | Bolt, slave, LP drive shaft front lifting fixture (1109) | 1002 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.



| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|--------------|
| 1450 * 1301 | PJ.695729 P3C.869244 | Fixture, LP drive shaft front Vice holder, LP signal shaft serrated sleeve | 1002 1003 |
| * 1452 | POJ.868978 | Fixture, LP signal shaft tube | 1003 |
| * 1614 | P3C.869245 | Spanner wrench, LP signal shaft plug | 1003 |
| 1378 | POJ.1077509 | Container, LP signal shaft and generating mechanism items | 1003 |

Disassembly Tools Table 1001 (Concluded)

з. LP Drive Shaft Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 89 | P3C.1050045 | Pad, retainer, LP drive shaft stiffening disk | 1003 |
| 88 | P3C.1050044 | Retainer, LP drive shaft stiffening disk | 1003 |
| * 1109 | P3C.699947 | Lifting fixture, LP drive shaft front | 1002 |
| * 328 | P3C.1073289 | Bolt, slave, LP drive shaft front lifting fixture (1109) | 1002 |
| * 1110 | P3C.699948 | Build/strip stand, LP drive shaft | 1001 |
| 1253 | PJ.863684 | Mobile stand, LP shaft front (vertical position) | 1004 |
| 590 | P3C.1288021 | Mobile stand, LP shaft front | 1004 |
| * 1055 | P3C.695737 | Lifting fixture, LP drive shaft rear | 1001 |
| 1068 | P3C.695754 | Lifting fixture, LP drive shaft (front end) | 1005 |
| * 1332 | PJ.893292 | Mobile stand, LP drive shaft (horizontal position) | 1005 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC. 72-31-04 Page 1002 Aug 1/78



| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| * 589 | P3C.1246976 | Mobile stand, LP drive shaft (horizontal position) | 1005 |
| * 1305 | P3C.871919 | Mechanical puller, LP drive shaft sleeve removal | 1001 |
| * 408 | P3C.1083354 | Protector, LP drive shaft rear splines | 1001 |
| ,* 999 | PJ.1234583 | Protector, LP drive shaft front splines/labyrinth | 1001 |

Assembly Tools Table 1002 (Concluded)

4. LP Drive Shaft Concentricity and Balancing Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| 1073 | P3C.695763 | Support, LP drive shaft | 1006 |
| 1074 | P3C.695764 | Spacer, LP drive shaft | 1006 |
| 1154 | P3C.1259728 | Bearing, adjustable, LP drive shaft | 1006 |
| 1153 | PT.1259733 | Locating arm, adjustable bearing (1154) | 1006 |
| 1641 | T.225614 | Setting gauge, adjustable bearing (1154) | 1006 |
| 1143 | P3C.850930 | Adapter, front, beam type sling (1145) | 1006 |
| 1144 | P3C.850931 | Adapter, rear, beam type sling (1145) | 1007 |
| 1145 | P3C.850932 | Sling, beam type, LP drive shaft | 1007 |
| * 408 | P3C.1083354 | Protector, LP drive shaft rear splines | 1001 |

Concentricity and Balancing Tools Table 1003 (Continued)

SPECIAL TOOLS ETC.

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| | rool ef.no. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---|----------------|--------------------------|--|------|
| * | 1332 | PJ.893292 | Mobile stand, LP drive shaft (horizontal position) | 1005 |
| * | 589 | P3C.1246976 | Mobile stand, LP drive shaft (horizontal position) | 1005 |
| | 1092 | P3C.699312 | Transporter, LP drive shaft | 1007 |
| | 109 | P3C.1062853 | Bracket, tie bar, balancing machine | 1007 |
| | 212 | P3C.1065902 | Tie bar, balancing machine | 1007 |
| * | 999 | PJ.1234583 | Protector, LP drive shaft front splines/labyrinth | 1001 |

Concentricity and Balancing Tools Table 1003 (Concluded)

5. LP Signal System Assembly and Setting Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|--|------|
| * 1301 | P3C.869244 | Vice holder, LP signal shaft serrated sleeve | 1003 |
| * 1614 | P3C.869245 | Spanner wrench, LP signal shaft plug | 1003 |
| 610 | P3C.1089118 | Alignment tool, LP rotor centre rear | 1008 |
| 609 | P3C.1089117 | Split sleeve, LP signal shaft quide | 1008 |
| 579 | P3C.1089046 | Locking tube, slave, LP drive shaft | 1008 |
| 580 | P3C.1089047 | Container, slave locking tube (579) | 1008 |
| 1323 | P3C.893237 | Lifting fixture, LP signal shaft | 1008 |
| 611 | P3C.1089119 | Alignment tool, LP signal shaft sleeves | 1008 |
| 17 | P3C.1072878 | Setting gauge, signal system | 1009 |

Assembly and Setting Tools Table 1004 (Continued)

SPECIAL TOOLS ETC.

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| | TOOL EF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---|----------------|--------------------------|---|------|
| | 18 | P3C.1072879 | Setting gauge, signal system guide and nut | 1009 |
| | 1296 | P3C.869209 | Spacer ring, slave, signal system items | 1009 |
| | 19 | P3C.1072880 | Checking gauge, signal system guide | 1009 |
| | 202 | PG.1072881 | Container, setting gauges (17,18 and 19) | 1009 |
| * | 1452 | POJ.868978 | Fixture, LP signal shaft tube | 1003 |
| * | 408 | P3C.1083354 | Protector, LP drive shaft rear splines | 1001 |
| * | 999 | PJ.1234583 | Protector, LP drive shaft front splines/labyrinth | 1001 |

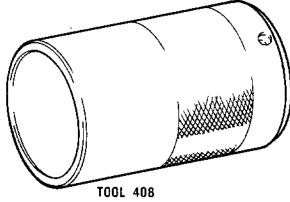
Assembly and Setting Tools Table 1004 (Concluded)

SPECIAL TOOLS ETC.

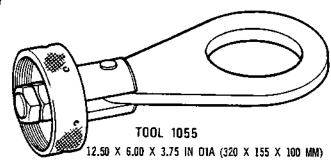
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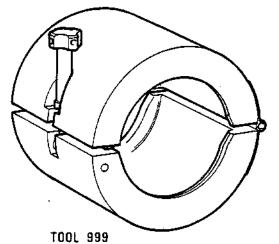




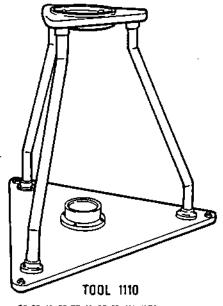


8.25 X 5.25 IN DIA (210 X 135 MM)

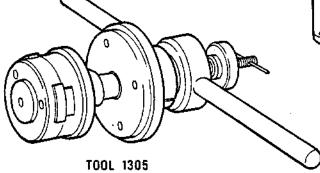




6.75 X 6.25 X 5.25 IN (175 X 160 X 135 MM)



38.00 X 33.75 X 32.50 IN (970 X 860 X 830 MM)



12.25 X 7.50 X 3.25 IN DIA (315 X 195 X 85 MM)

LP Compressor Drive Shaft - Special Tools Figure 1001

SPECIAL TOOLS ETC.

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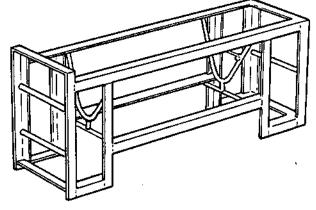
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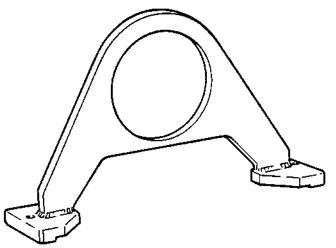
MK.610-14-28 OVERHAUL



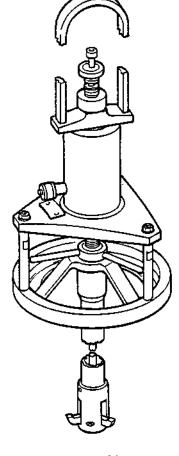
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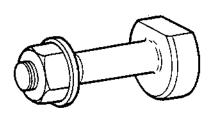
TOOL 1451 37.50 X 16.00 X 13.00 IN (955 X 410 X 335 MM)



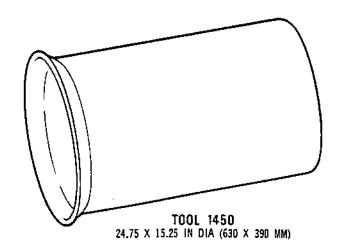
TOOL 1109 10.50 X 6.75 X 3.00 IN (270 X 175 X 80 MM)



TOOL 655 54.50 X 11.25 IN DIA (1385 X 290 MM)



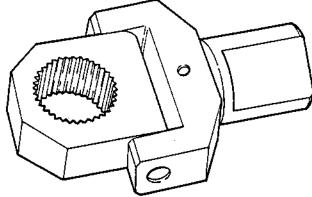
TOOL 328 1.50 X 0.75 IN DIA (40 X 20 MM)



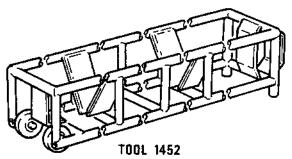
LP Compressor Drive Shaft - Special Tools Figure 1002

SPECIAL TOOLS ETC.

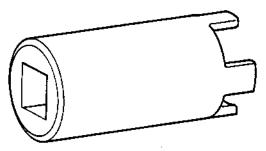
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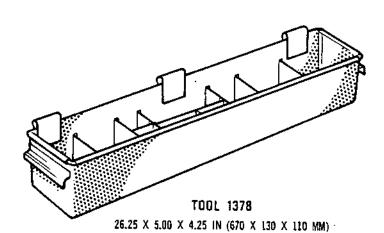
TOOL 1301 6.50 X 4.00 X 2.00 IN DIA (170 X 105 X 55 MM)

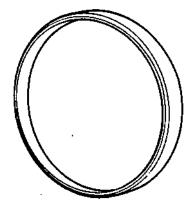


92.75 X 6.00 X 4.75 IN (2360 X 155 X 125 MM)

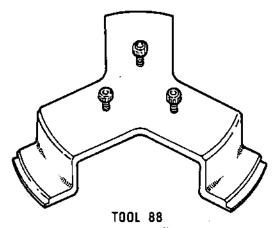


TOOL 1614 2.50 X 1.25 IN DIA (65 X 35 MM)





TOOL 89 0.50 X 4.00 IN DIA (15 X 105 MM)



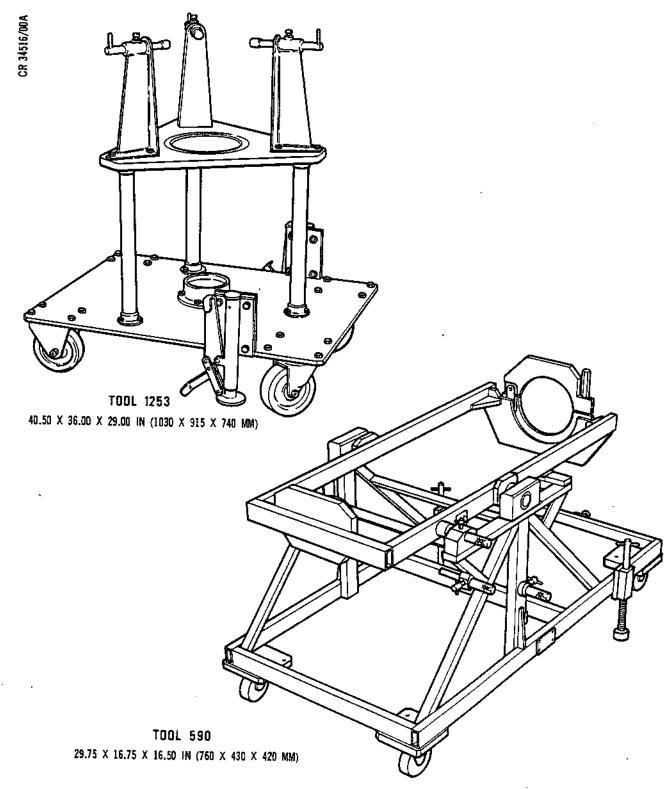
2.75 X 9.00 IN DIA (70 X 230 MM)

LP Compressor Drive Shaft - Special Tools Figure 1003

SPECIAL TOOLS ETC.

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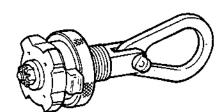




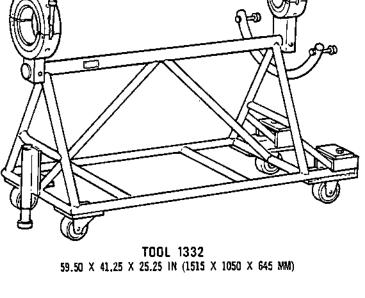
LP Compressor Drive Shaft - Special Tools. Figure 1004

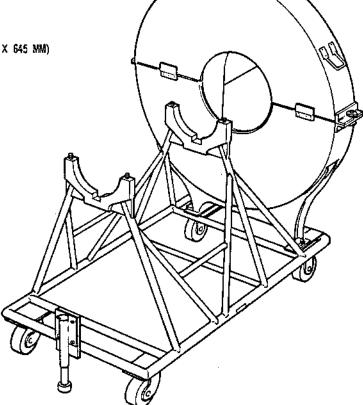
SPECIAL TOOLS ETC.

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TOOL 1068 9.50 X 3,50 IN DIA (245 X 90 MM)





TOOL 589 66.50 X 61.00 X 51.00 IN (1690 X 1550 X 1300 MM)

LP Compressor Drive Shaft - Special Tools Figure 1005

SPECIAL TOOLS ETC.

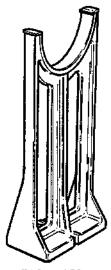
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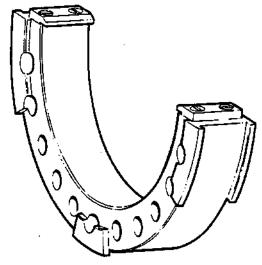
OVERHAUL



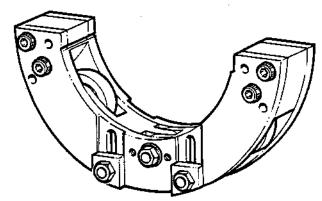
CR 34518/00A



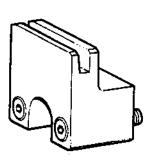
TOOL 1073 30.50 X 15.00 X 9.50 IN (775 X 385 X 245 MM)



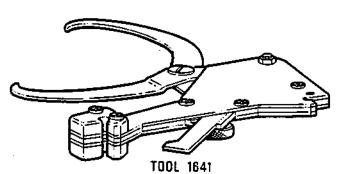
TOOL 1074 13.50 X 7.00 X 2.50 IN (345 X 180 X 65 MM)



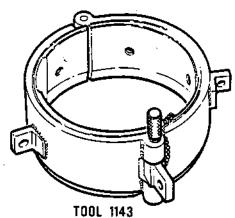
TOOL 1154 10.00 X 5.00 X 3.00 IN (255 X 130 X 80 MM)



TOOL 1153 2.00 X 2.00 X 1.50 IN (55 X 55 X 40 MM)



10.50 X 8.50 X 1.75 IN (270 X 220 X 45 MM)



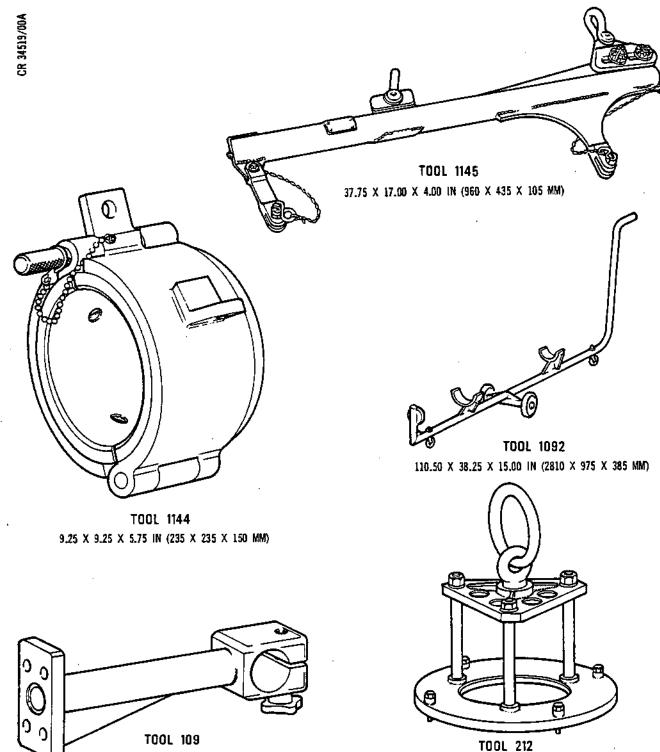
12.00 X 12.00 X 5.75 IN (305 X 305 X 150 MM)

LP Compressor Drive Shaft - Special Tools Figure 1006

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LP Compressor Drive Shaft - Special Tools Figure 1007

14.00 X 5.00 X 2.50 IN (360 X 130 X 65 MM)

SPECIAL TOOLS ETC.

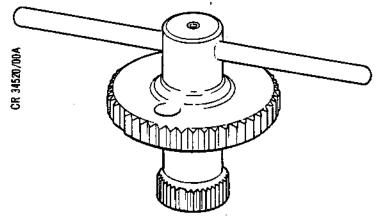
14.25 X 12.25 IN DIA (365 X 315 MM)

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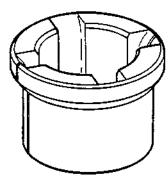


OVERHAUL

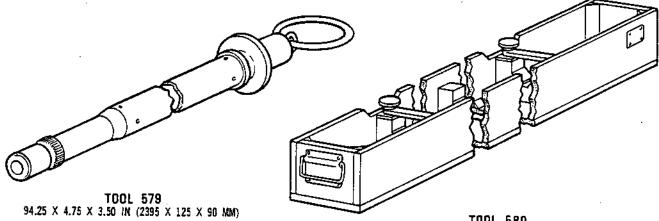




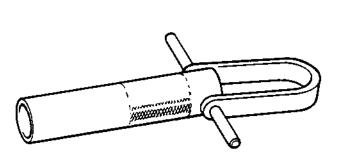
TOOL 610 10.00 X 5.25 X 4.50 IN (255 X 135 X 115 MM)



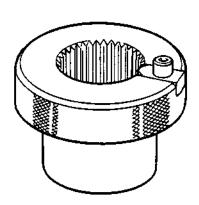
TOOL 609 2.25 X 3.25 IN DIA (60 X 85 MM)



TOOL 580 $^{\circ}$ 99.25 X 6.25 X 5.50 IN (2525 X 160 X 140 MM)



TOOL 1323 9.50 \times 6.00 \times 1.50 IN DIA (245 \times 155 \times 40 MM)

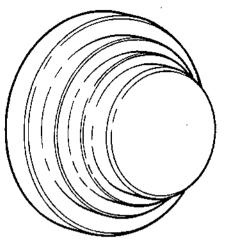


TOOL 611 2.75 X 3.50 IN DIA (70 X 90 MM)

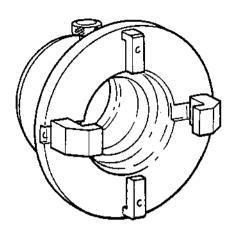
LP Compressor Drive Shaft - Special Tools Figure 1008

SPECIAL TOOLS ETC.

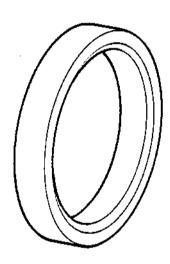
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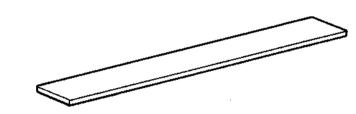
TOOL 17 1.25 X 3.00 IN DIA (35 X 80 MM)



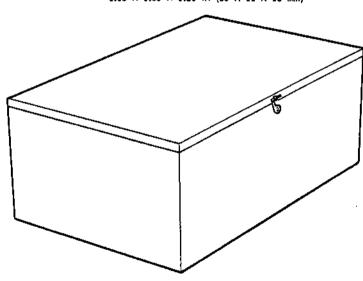
TOOL 18 3.25 X 4.50 IN DIA (85 X 115 MM)



TOOL 1296 0.50 X 2.00 IN DIA (15 X 55 MM)



TOOL 19 3.00 × 0.50 × 0.25 IN (80 × 15 × 10 MM)



TOOL 202 9.00 X 5.50 X 3.25 IN (230 X 140 X 85 MM)

LP Compressor Drive Shaft - Special Tools Figure 1009

SPECIAL TOOLS ETC.

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INTERMEDIATE CASE, SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the intermediate case assembly.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. Pictorial views of the tools are illustrated and reference to the relevant Fig. No. is included in the tables.

2. <u>Compressor Intermediate Case_Disassembly Tools</u>

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---|-------------|
| *1089 | P3C.695798 | Multiple leg sling, intermediate case | 1001 |
| * 434 | P3C.1083396 | Retainer, HP bevel gear and bearing | 1001 |
| * 1263 | P3C.865951 | Disassembly/assembly stand, intermediate case | 1001 |
| * 823 | P30.1094717 | Mechanical puller, inner labyrinth housing | 1001 |
| *1668 | T.914825 | Puller, general application (Pre.SB.OL.72-8305-154 standard engines) | 1001 |
| 3154 | \$3\$20077000 | Hydraulic extractor (Pre. and Post SB.OL.72- 8305-154 standard engines) | 1033 |
| 932 | P3C.1229292 | Mechanical puller, air baffle | 1001 |
| * 959 | P3C.1229384 | Mechanical puller, hollow pin (Pre SB.72-8678-249) | 1002 |
| | \$38.15741000 | Mechanical puller, hollow pin (SB.72-8678-249) | |
| * 572 | P3C.1089037 | Protector, oil pressure switch location (vane 4) | 1002 |
| * 571 | P3C.1089036 | Protector, oil pressure trans- mitter location (vane 4) | 1002 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|-----------------------|--|-------------|
| * 570 | P3C.1089035 | Protector, LP pulse probe | 1002 |
| | | location (vane 4) | |
| *1527 | P3C.1089107 | Wrench, gland nuts (vane 4) | 1002 |
| 341 | P3C.1083203 | Mechanical driver, shaft from housing (vane 4) | 1002 |
| 177 | P3C.1065845 | Puller, quillshaft | 1003 |
| * 336 | P3C.1076079 | Vice holder, bearing assembly (vane 4) | 1003 |
| * 339 | P3C.1083201 | Driver, bearing retaining nut (vane 4) | 1003 |
| 342 | P3C.1083204 | Mechanical puller, bearing from shaft (vane 4) | 1003 |
| *1494 | P3C.1072900 | Wrench, bearing failure warning tube nut (vane 2) | 1003 |
| * 1581 | P3C.1234412 | Ring wrench, bevel gear (vane 4) | 1003 |
| * 356 | P3C.1083216 | Vice holder, bevel gear | 1004 |
| *1516 | P3C.1083215 | Wrench, bearing retaining nut (vane 4) | 1004 |
| 355 | P3C.1083214 | Support, LP gear (vane 4) | 1004 |
| 1515 | P3C.1083213 | Driver, gear assembly | 1004 |
| 353 | P3C.1083210 | Draw screw puller, bearing housing | 1004 |
| 352 | P3C.1083209 | Mechanical puller, roller bearing outer track | 1005 |
| * 256 | P3C.1072919 | Support, accessory drive | 1005 |
| 10 | · \$3\$.10187000 | • | |
| * 327 | P3C.1073288 | Socket wrench, accessory gear retaining nut (vane 5) | 1005 |
| 623 | P3C.1089140 | Split collar, accessory gear (vane 5) | 1005 |
| 622 | P3C.1089139 | Support, accessory gear (vane 5) | 1005 |
| 630 | P3C.1089141 | Driver, accessory gear (vane 5) | 1006 |
| 701 | P3C.1089279 | Mechanical puller, accessory drive bearing (vane 5) | 1006 |
| 544 | P3C.1089003 | Mechanical puller, accessory drive bearing (vane 5) | 1006 |
| 255 | P3C.1072914 | Mechanical puller, accessory drive bearing (vane 5) | 1006 |
| *1497 | P30.1072923 | Spanner wrench, accessory drive bearing nut (vane 3) | 1006 |
| 258 | P3C.1072922 | Mechanical puller, accessory bearings (vane 3) | 1007 |

Disassembly Tools Table 1001 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| 257 | P3C.1072921 | Mechanical puller, accessory bearings (vane 3) | 1007 |
| 3133 | S3S.13552000 | Mechanical puller | 1007 |
| 286 | P3C.1073109 | Mechanical puller, accessory bearings (vane 3) | 1007 |
| *1582 | P3C.1234413 | Holding spanner, drain tube and retainer nuts | 1007 |
| *1805 | P3C.1266510 | Slave bar, blanking plate | 1007 |
| * 3064 | P3C.1229397 | Alignment pin, inner case | 1007 |
| *3065 | P3C.1064694 | Assembly/disassembly fixture inner case | 1008 |
| 851 | P3C.1212122 | Ring, mechanical puller | 1008 |
| 897 | P3C.1212299 | Mechanical driver, labyrinth housing | 1008 |
| 828 | P3C.1094748 | Mechanical puller, labyrinth housing | 1008 |
| 1984 | PT.1073150 | Extractor, bearing balls | 1008 |
| 1985 | PT.1073151 | Extractor, bearing balls | 1008 |

Disassembly Tools Table 1001 (Concluded) THIS PAGE LEFT BLANK INTENTIONALLY

SPECIAL TOOLS ETC

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Compressor Intermediate Case Assembly and Oil Pressure Test Tools

| TOOL | MANUFACTURER | | FI G. |
|-----------------|--------------|--|--------------|
| TOOL REF.NO. | PART NO. | DESCRIPTION | NO. |
| 1800 | PT.1229224 | Driver, pin, outer case, rear inner flange | 1009 |
| 1801 | PT.1229225 | Driver, pin, outer case, front inner flange | 1009 |
| 1802 | PT.1229226 | Driver, pin, outer case, rear inner flange | 1009 |
| 1803 | PT.1229223 | Driver, pin, LP bearing housing front location | 1009 |
| 1804 | PT.1259732 | Driver, pin, static seal housing | 1009 |
| 1928 | PJ'.1229217 | Driver, pin, HP bearing housing retainer ring | 1009 |
| 1811 | PJ.1264606 | Location plate, Metaflex seals | 1009 |
| 1812 | PJ.1264607 | Location plate, Metaflex seals | 1009 |
| 1575 | P3C.1229358 | Wrench, assemble LP labyrinth housing/LP bearing housing | 1009 |
| 1986 | S3S15203000 | Assembly tool, bearing | 1010 |

Assembly Tools
Table 1002 (Continued)

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 1987 | S3S15204000 | Adapter plate, assembly tool | 1010 |
| 254 | P3C.1072912 | Support, accessory drive bearings | 1010 |
| 1495 | P3C.1072913 | Driver, accessory drive bearings | 1010 |
| 1264 | PJ.865955 | Mounting ring, intermediate case stand | 1010 |
| *1263 | P3C.865951 | Assembly/disassembly stand, intermediate case | 1001 |
| 1929 | PJ.1223109 | Platform, intermediate case stand | 1010 |
| 1930 | PJ.1223108 | Tray, intermediate case stand | 1011 |
| *1089 | P3C.695798 | Multiple leg sling, outer case | 1001 |
| *1805 | PT.1266510 | Slave bar, blanking plate | 1007 |
| *1668 | T.914825 | Puller, general application | 1001 |
| 1806 | P3C.1263678 | Setting tool, drain tube | 1011 |
| 1947 | PJ.1263662 | Holding tool, drain tube | 1011 |
| 1576 | P3C.1229359 | Wrench, ring cranked, inner case | 1011 |
| 1521 | P3C.1083304 | Wrench, ring cranked, tube unit | 1011 |
| 1807 | PJ.1255576 | Slave LP bearing | 1011 |
| 1808 | PJ.1255577 | Container, slave bearing | 1012 |
| 81 | P3C.894656 | Checking gauge, intermediate case | 1012 |
| 1809 | PJ.1288100 | Clamp assembly, slave bearing | 1012 |
| 1810 | PJ.1255508 | Lifting fixture, intermediate case | 1012 |
| 1822 | PJ.1234470 | Loading tool, slave bearing | 1012 |
| 1199 | P3C.858970 | Clamp, LP bevel gear, driven | 1012 |
| * 434 | PJ.1083396 | Retainer, HP bevel gear and bearing | 1001 |
| * 823 | PJ.1094717 | Mechanical puller, inner labyrinth | 1001 |
| 56 | PG.1234483 | Gauge, setting, right-hand accessory drive | 1013 |
| 324 | P3C.1073284 | Driver, intermediate case bearing | 1013 |
| 620 | P3C.1089137 | Driver, bearing, left-hand accessory housing | 1013 |
| 621 | P3C.1089138 | Support, bearing, left-hand accessory housing | 1013 |
| 40 | P3C.1089131 | Setting gauge, left-hand accessory housing | 1013 |
| 251 | P3C.1072902 | Spacer ring, HP bearing housing | 1014 |
| 1813 | P5G.1262659 | Setting gauge, HP bearing housing | 1014 |
| 253 | P3C.1072909 | Clamping plate, HP bearing housing | 1014 |
| 270 | P3C.1073093 | Container, setting gauge (1813) | 1014 |

Assembly Tools
Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| *1805 | P3C.1266510 | Slave bar, blanking plate | 1007 |
| *3064 | P3C.1229397 | Alignment pin, inner case | 1007 |
| *3065 | P3C.1064694 | Assembly/disassembly fixture inner case | 1008 |
| 851 | P3C.1212122 | Ring, mechanical puller | 1008 |
| 897 | P3C.1212299 | Mechanical driver, labyrinth housing | 1008 |
| 828 | P3C.1094748 | Mechanical puller, labyrinth housing | 1008 |
| 1984 | PT.1073150 | Extractor, bearing balls | 1008 |
| 1985 | PT.1073151 | Extractor, bearing balls | 1008 |

Disassembly Tools Table 1001 (Concluded)

3. Compressor Intermediate Case Assembly and Oil Pressure Test Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 1800 | PT.1229224 | Driver, pin, outer case, rear inner flange | 1009 |
| 1801 | PT.1229225 | Driver, pin, outer case, front inner flange | 1009 |
| 1802 | PT.1229226 | Driver, pin, outer case, rear inner flange | 1009 |
| 1803 | PT.1229223 | Driver, pin, LP bearing housing front location | 1009 |
| 1804 | PT.1259732 | Driver, pin, static seal housing | 1009 |
| 1928 | PJ.1229217 | Driver, pin, HP bearing housing, retainer ring | 1009 |
| 1811 | PJ.1264606 | Location plate, Metaflex seals | 1009 |
| 1812 | PJ.1264607 | Location plate, Metaflex seals | 1009 |
| 1575 | P3C.1229358 | Wrench, assemble LP labyrinth housing/LP bearing housing | 1009 |
| 1986 | S3S15203000 | Assembly tool, bearing | 1010 |

Assembly Tools Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| 1987 | S3S15204000 | Adapter plate, assembly tool | 1010 |
| 254 | P3C.1072912 | Support, accessory drive bearings | 1010 |
| 1495 | P3C.1072913 | Driver, accessory drive bearings | 1010 |
| 1264 | PJ.865955 | Mounting ring, intermediate case stand | 1010 |
| *1263 | P3C.865951 | Assembly/disassembly stand, intermediate case | 1001 |
| 1929 | PJ.1223109 | Platform, intermediate case stand | 1010 |
| 1930 | PJ.1223108 | Tray, intermediate case stand | 1011 |
| *1089 | P3C.695798 | Multiple leg sling, outer case | 1001 |
| *1805 | PT.1266510 | Slave bar, blanking plate | 1007 |
| *1668 | T.914825 | Puller, general application | 1001 |
| 1806 | P3C.1263678 | Setting tool, drain tube | 1011 |
| 1947 | PJ.1263662 | Holding tool, drain tube | 1011 |
| 1576 | P3C.1229359 | Wrench, ring cranked, inner case | 1011 |
| 1521 | P3C.1083304 | Wrench, ring cranked, tube unit | 1011 |
| 1807 | PJ.1255576 | Slave LP bearing | 1011 |
| 1808 | PJ.1255577 | Container, slave bearing | 1012 |
| 81 | P3C.894656 | Checking gauge, intermediate case | 1012 |
| 1809 | PJ.1288100 | Clamp assembly, slave bearing | 1012 |
| 1810 | PJ.1255508 | Lifting fixture, intermediate case | 1012 |
| 1822 | PJ.1234470 | Loading tool, slave bearing | 1012 |
| 1199 | P3C.858970 | Clamp, LP bevel gear, driven | 1012 |
| * 434 | PJ.1083396 | Retainer, HP bevel gear and bearing | 1001 |
| * 823 | PJ.1094717 | Mechanical puller, inner labyrinth | 1001 |
| 56 | PG.1234483 | Gauge, setting, right-hand accessory drive | 1013 |
| 324 | P3C.1073284 | Driver, intermediate case bearing | 1013 |
| 620 | P3C.1089137 | Driver, bearing, left-hand accessory housing | 1013 |
| 621 | P3C.1089138 | Support, bearing, left-hand accessory housing | 1013 |
| 40 | P3C.1089131 | Setting gauge, left-hand accessory housing | 1013 |
| 251 | P3C.1072902 | Spacer ring, HP bearing housing | 1014 |
| 1813 | P5G.1262659 | Setting gauge, HP bearing housing | 1014 |
| 253 | P3C.1072909 | Clamping plate, HP bearing housing | 1014 |
| | P3C.1073093 | Container, setting gauge (1813) | 1014 |

Assembly Tools Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| *1582 | P3C.1234413 | Holding spanner, drain tube | 1007 |
| 350 | P30.1083207 | retainer nuts Driver, bearing, LP pulse probe housing | 1014 |
| 351 | P3C.1083208 | Support, bearing, LP pulse probe | 1014 |
| 31 | P3C.1083205 | Setting gauge, LP bevel gear | 1015 |
| 935 | P3C.1229310 | Extension, setting gauge, LP bevel gear | 1015 |
| 41 | P3C.1089166 | Setting gauge, LP bearing housing | 1015 |
| 3 43 | P3C.1083206 | Container, gauge, LP bevel gear | 1015 |
| *1494 | P3C.1072900 | Wrench, bearing failure warning, tube nut (vane 2) | 1003 |
| 849 | P3C.1094889 | Adapter, torque setting rig | 1015 |
| 568 | P30.1089031 | Protector, oil feed housing | 1015 |
| 1365 | P3C.899354 | Protector, tube | 1016 |
| 930 | PJ.1229290 | Alignment fixture, HP air baffle | 1016 |
| 1514 | P3C.1083211 | Driver, bearing to LP pulse probe housing | 1016 |
| 354 | P3C 1083212 | Support, bearing to LP pulse probe housing | 1016 |
| * 356 | P3C.1083216 | Vice holder, bevel gear | 1004 |
| *1516 | P3C.1083215 | Wrench, bearing retaining nut | 1004 |
| *1581 | P3C.1234412 | Ring wrench, bevel gear (vane 4) | 1003 |
| 1496 | P3C.1072920 | Driver, bearing, right-hand accessory drive | 1016 |
| * 256 | P3C.1072919 | Support, accessory drive | 1005 |
| | · s3s10187000 | | |
| * 1497 | P3C.1072923 | Spanner wrench, accessory drive bearing nut | 1006 |
| 1629 | P3C.898067 | Wrench, ring, cranked, right-hand accessory (vane 3 and 4) | 1016 |
| 323 | P3C.1073283 | Driver, bearing, left-hand accessory drive | 1017 |
| * 327 | P3C.1073288 | Socket wrench, accessory gear retaining nut | 1005 |
| 635 | P3C.1089167 | Special nut, LP bevel gear | 1017 |
| 359 | P3C.1083219 | Dial indicator adapter, LP driven bevel backlash | 1017 |
| 357 | P3C.1083217 | Indicating fixture, LP driven bevel backlash | 1017 |
| 358 | P3C.1083218 | Collet, LP driven bevel backlash | 1017 |
| 250 | P3C.1072901 | Spacer ring, LP bearing housing | 1017 |
| | | | |

Assembly Tools Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 360 | P3C.1083220 | Container, LP bevel gear backlash gauge | 1018 |
| 960 | P3C.1229385 | Special nut, HP bevel gears | 1018 |
| 617 | P3C.1089134 | Checking fixture, HP bevel gears | 1018 |
| | | backlash | |
| 618 | P3C.1089135 | Indicating fixture, HP bevel gears backlash | 1018 |
| 619 | P3C.1089136 | Indicating fixture, HP bevel qears backlash | 1018 |
| 631 | P3C.1089142 | Container, backlash gauges | 1018 |
| 21 | P3C.1072974 | Measuring fixture, LP probe | 1019 |
| | | adjusting washer check | |
| 263 | P3C.1073056 | Container, fixture (21) | 1019 |
| 826 | P3C.1094723 | Fixture, HP probe check | 1019 |
| 44 | P3C.1094721 | Gauge, HP probe check | 1019 |
| 825 | P3C.1094722 | Container, gauge (44) | 1019 |
| 433 | P3C.1083395 | Blank, pressure test, oil distributor | 1019 |
| 1814 | PJ.1234431 | Protector, oil distributor, LP bearing feed | 1020 |
| 1815 | PJ.1234517 | Protector, oil distributor, HP bearing feed | 1020 |
| 1816 | P3C.1083398 | Protector, oil distributor, oil jet | 1020 |
| 565 | P3C.1089028 | Protector, oil distributor, cross-feed location | 1020 |
| 1817 | P3C.1234433 | Protector, oil distributor | 1020 |
| 1507 | P3C.1073163 | Assembly sleeve, retaining rings | 1020 |
| 553 | P3C.1089022 | Retaining plate, intermediate case dowels | |
| * 959 | P3C.1229384 | Mechanical puller, hollow pins (Pre SB.72-8678-249) | 1002 |
| | S3S.15741000 | Mechanical puller, hollow pins (SB.72-8678-249) | |
| 576 | P3C.1089041 | Protector, intermediate case | 1021 |
| 577 | P3C.1089042 | Pillar nut, intermediate case | 1021 |
| 436 | P3C.1086725 | Protector, intermediate case | 1021 |
| 1561 | P3C.1089024 | Retaining plate, intermediate case dowels | 1021 |
| 702 | P3C.1089280 | Protector, right-hand gearbox mounting bracket (Pre SB.72-8689-272) | 1021 |
| 3124 | s3s.15812000 | Protector, right-hand gearbox mounting bracket (SB.72-8689-272) | 1032 |

Assembly Tools Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 569 | P3C.1089034 | Protector oil drain tube (vane 4) | 1022 |
| *1527 | P3C.1089107 | Wrench, gland nuts (vane 4) | 1002 |
| * 339 | PJ.1083201 | Driver, bearing retaining nut (vane 4) | 1003 |
| 337 | P3C.1076080 | Support, bearing to drive shaft (vane 4) | 1022 |
| * 336 | P3C.1076079 | Vice holder, bearing assembly (vane 4) | 1003 |
| 340 | P3C.1083202 | Mechanical driver, drive shaft and bearing assembly (vane 4) | 1022 |
| 574 | P3C.1089039 | Protector, bearing failure warning tube (vane 2) | 1022 |
| 573 | P3C.1089038 | Protector, scavenge tube (vane 4) | 1022 |
| * 570 | P3C.1089035 | Protector, LP pulse probe location (vane 4) | 1002 |
| * 571 | P3C.1089036 | Protector, oil transmitter (vane 4) | 1002 |
| * 572 | P3C.1089037 | Protector, oil pressure switch (vane 4) | 1002 |
| 399 | P3C.1083330 | Blank, LP thrust bearing oil supply tube (vane 2) | 1022 |
| 957 | P3C.1229382 | Mechanical puller, hollow pins | 1023 |
| 958 | P3C.1229383 | Mechanical puller, hollow pins | 1023 |
| 197 | P3C.1065891 | Lifting fixture, left-hand gearbox | |
| 1302 | P3C.869247 | Turnbuckle, lifting fixture (197) | 1023 |
| 1631 | | Salter spring balance | 1023 |
| 1934 | P3C.1262655 | Protector, left-hand gearbox | 1023 |
| 199 | P3C.1065893 | Protector, left-hand gearbox | 1024 |
| 793 | P3C.1089439 | Lifting fixture, right-hand gearbox | 1024 |
| 794 | P3C.1089440 | Lifting adapter, adapter right- hand gearbox | 1024 |
| 795 | P3C.1089441 | Lifting fixture, adapter right- hand gearbox | 1024 |
| 827 | P3C.1094724 | Lifting fixture, adapter right- hand gearbox | 1024 |
| 562 | P3C.1089025 | Plate retaining, mounting bracket | 1025 |
| * 785 | P3C.1089424 | Protector, inclined bevel gear drive coupling, right-hand gearbox (Pre SB.72-8689-272) | 1025 |

Assembly Tools Table 1002 (Continued)

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| *3126 S3S.15812000 Protector, inclined bevel gear coupling, right-hand gearbox (SB.72-8689-272) 249 PJ.1072899 Spacer ring, HP bearing housing 1915 PJ.1259752 Blank, pressure test 1916 PJ.1259753 Blank, pressure test 252 P3C.1072908 Spacer ring, LP bearing housing 1932 PJ.1244707 Blank, LP bearing feed transfer tube 432 P3C.1083394 Blank, LP bearing feed transfer tube 1820 PJ.1234516 Seal plate, pressure test 252 Blank, pressure test 253 Blank, pressure test 254 Blank, pressure test 255 Blank, pressure test 256 Blank, pressure test 267 Blank, pressure test 270 Blank, pressure 470 Blank, | FIG NO. | DESCRIPTION | TOOL REF.NO. |
|--|------------|---------------------------------|-----------------|
| PJ.1072899 Spacer ring, HP bearing housing | 103 | coupling, right-hand gearbox | *3126 |
| 1915 PJ.1259752 Blank, pressure test 1916 PJ.1259753 Blank, pressure test 252 P3C.1072908 Spacer ring, LP bearing housing 1932 PJ.1244707 Blank, LP bearing feed transfer tube 432 P3C.1083394 Blank, LP bearing feed transfer tube 432 P3C.1083394 Blank, LP bearing feed transfer tube 432 PJ.1234516 Seal plate, pressure test 616 PJ.1089128 Blank, pressure test 616 PJ.1089128 Blank, pressure test 617 PJ.1086743 Blank, pressure test 618 PJ.1244686 Adapter, pressure test 619 PJ.1086748 Blank, pressure test 620 PJ.1086738 Blank, pressure test 631 PJ.1086738 Blank, pressure test 632 PJ.1089254 Locking ring, pressure test 633 PJ.1089253 Blank, pressure test 642 PJ.1089253 Blank, pressure test 643 PJ.1244687 Blank, pressure test 644 PJ.1089253 Blank, pressure test 654 PJ.1212264 Blank, pressure test 655 PJ.1089085 Blank, pressure test 656 PJ.1089085 Relief valve, pressure test 657 PJ.1089086 Gauge adapter, pressure test 658 PJ.1089072 Air rig, pressure test 659 PJ.1089086 Gauge adapter, pressure test 650 PJ.1089087 Air rig, pressure test 651 PJ.1089072 Air rig, pressure test 652 PJ.1089087 Blank, turbo-pump air supply 653 PJ.1089044 Protector, pressure air supply 654 PJ.1089044 Protector, pressure air supply 655 PJ.1089044 Protector, pressure air supply 656 PJ.1089044 Protector, pressure air supply 657 PJ.1089044 Protector, pressure air supply 658 PJ.1089044 Protector, pressure air supply 658 PJ.1089044 Protector, pressure air supply 658 PJ.1089044 Protector, pressure air 659 PJ.1089044 Protector, pressure air 650 PJ.1089044 PJ.1089040 PJ.1089040 650 PJ.1089040 PJ.1089040 PJ.1089 | 102 | | 249 |
| 1916 | 102 | | |
| P3C.1072908 Spacer ring, LP bearing housing | 102 | | |
| PJ.1244707 Blank, LP bearing feed transfer tube | 102 | | |
| tube 1820 PJ.1234516 Seal plate, pressure test 616 PJ.1089128 Blank, pressure test 1819 PJ.1244686 Adapter, pressure test 441 PJ.1086743 Blank, pressure test 439 PJ.1086738 Blank, pressure test (Pre SB.72-8689-272) 3123 S3S.15814000 Blank, pressure test (SB.72-8689-272) 690 PJ.1089254 Locking ring, pressure test 442 PJ.1086744 Adapter, pressure test (vane 3) 689 PJ.1089253 Blank, pressure test 815 PJ.1244687 Blank, pressure test 816 PJ.1089494 Blank, pressure test 816 PJ.1089495 Blank, pressure test 816 PJ.1089495 Blank, pressure test 817 PJ.1073280 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 829 PJ.1094755 Protection screen 829 PJ.1089086 Relief valve, pressure test 836 PJ.1089086 Gauge adapter, pressure test 84 PJ.1089072 Air rig, pressure test 85 PJ.1089072 Air rig, pressure test 85 PJ.1089072 Air rig, pressure test 85 PJ.1089070 Blank, turbo-pump air supply 85 PJ.1089044 Protector, pressure air supply | 102 | Blank, LP bearing feed transfer | |
| 816 PJ.1089128 Blank, pressure test 441 PJ.1086743 Blank, pressure test 441 PJ.1086738 Blank, pressure test 439 PJ.1086738 Blank, pressure test (Pre SB.72-8689-272) 3123 S3S.15814000 Blank, pressure test (SB.72-8689-272) 690 PJ.1089254 Locking ring, pressure test 442 PJ.1086744 Adapter, pressure test 442 PJ.1089253 Blank, pressure test (vane 3) 689 PJ.1089253 Blank, pressure test 815 P3C.1089494 Blank, pressure test 816 P3C.1089495 Blank, pressure test 816 P3C.1089495 Blank, pressure test 820 PJ.1212264 Blank, pressure test 821 PJ.1094755 Protection screen 822 PJ.1073280 Test rig, mobile, oil pressure 823 PJ.1073280 Oil pressure test 835 P3C.1089085 Gauge adapter, pressure test 84 PJ.1089072 Air rig, pressure test 85 PJ.1089072 Air rig, pressure test 85 PJ.1089070 Blank, turbo-pump air supply 878 P3C.1089044 Protector, pressure air supply | 102 | | 432 |
| 1819 PJ.1244686 Adapter, pressure test 441 PJ.1086743 Blank, pressure test (Pre SB.72-8689-272) | 102 | Seal plate, pressure test | 1820 |
| 441 PJ.1086743 Blank, pressure test 439 PJ.1086738 Blank, pressure test (Pre SB.72-8689-272) 3123 S3S.15814000 Blank, pressure test (SB.72-8689-272) 690 PJ.1089254 Locking ring, pressure test 442 PJ.1086744 Adapter, pressure test (vane 3) 689 PJ.1089253 Blank, pressure test 1821 PJ.1244687 Blank, pressure test 815 P3C.1089494 Blank, pressure test 816 P3C.1089495 Blank, pressure test 817 PJ.1073280 Test rig, mobile, oil pressure 829 PJ.1212264 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 829 PJ.1094755 Protection screen 829 PJ.1073280 Oil pressure test 829 PJ.1089085 Relief valve, pressure test 836 PJ.1089086 Gauge adapter, pressure test 84 PJ.1089072 Air rig, pressure test 8584 PJ.1089072 Air rig, pressure test 8584 PJ.1089072 Air rig, pressure test 8584 PJ.1089072 Blank, turbo-pump air supply 8578 P3C.1089044 Protector, pressure air supply | 102 | Blank, pressure test | 616 |
| ### PJ.1086738 Blank, pressure test | 102 | | |
| (Pre SB.72-8689-272) 3123 S3S.15814000 Blank, pressure test | 102 | Blank, pressure test | 441 |
| (SB.72-8689-272) 690 PJ.1089254 Locking ring, pressure test 442 PJ.1086744 Adapter, pressure test (vane 3) 689 PJ.1089253 Blank, pressure test 1821 PJ.1244687 Blank, pressure test 815 P3C.1089494 Blank, pressure test 816 P3C.1089495 Blank, pressure test 892 PJ.1212264 Blank, pressure test 1926 S3S.10753000 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 1917 PJ.1073280 Oil pressure test rig 595 P3C.1089085 Relief valve, pressure test 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | | 439 |
| 442 PJ.1086744 Adapter, pressure test (vane 3) 689 PJ.1089253 Blank, pressure test 812 PJ.1244687 Blank, pressure test 815 P3C.1089494 Blank, pressure test 816 P3C.1089495 Blank, pressure test 892 PJ.1212264 Blank, pressure test 1926 S3S.10753000 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 829 PJ.1073280 Oil pressure test rig 829 PJ.1073280 Oil pressure test rig 835 P3C.1089085 Relief valve, pressure test 84 PJ.1089072 Air rig, pressure test 854 PJ.1089072 Air rig, pressure test 855 P3C.862312 Container, LP bearing assembly 8578 P3C.1089044 Protector, pressure air supply | 103 | | 3123 |
| 889 PJ.1089253 Blank, pressure test 815 PJ.1244687 Blank, pressure test 816 PJ.1089494 Blank, pressure test 817 PJ.1212264 Blank, pressure test 818 PJ.1212264 Blank, pressure test 819 PJ.1212264 Blank, pressure test 819 PJ.1094755 Protection screen 829 PJ.1094755 Protection screen 829 PJ.1073280 Oil pressure test rig 829 PJ.1073280 Oil pressure test rig 820 PJ.1089085 Relief valve, pressure test 821 PJ.1089086 Gauge adapter, pressure test 822 PJ.1089072 Air rig, pressure test 823 PJ.1089072 Air rig, pressure test 824 PJ.1089072 Blank, turbo-pump air supply 825 PJ.1089044 Protector, pressure air supply | 102 | | 690 |
| 1821 PJ.1244687 Blank, pressure test 815 | 102 | Adapter, pressure test (vane 3) | 442 |
| 815 P3C.1089494 Blank, pressure test 816 P3C.1089495 Blank, pressure test 892 PJ.1212264 Blank, pressure test 1926 S3S.10753000 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 1917 PJ.1073280 Oil pressure test rig 1926 P3C.1089085 Relief valve, pressure test 1927 P3C.1089086 Gauge adapter, pressure test 1928 P3C.1089072 Air rig, pressure test 1929 P3C.1065970 Blank, turbo-pump air supply 1920 elbow 1930 P3C.1089044 Protector, pressure air supply | 102 | Blank, pressure test | 689 |
| 816 | 102 | Blank, pressure test | 1821 |
| 892 PJ.1212264 Blank, pressure test 1926 S3S.10753000 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 1917 PJ.1073280 Oil pressure test rig 595 P3C.1089085 Relief valve, pressure test 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | Blank, pressure test | 815 |
| 1926 S3S.10753000 Test rig, mobile, oil pressure 829 PJ.1094755 Protection screen 1917 PJ.1073280 Oil pressure test rig 595 P3C.1089085 Relief valve, pressure test 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | Blank, pressure test | 816 |
| 829 PJ.1094755 Protection screen 1917 PJ.1073280 Oil pressure test rig 595 P3C.1089085 Relief valve, pressure test 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | Blank, pressure test | 892 |
| 1917 PJ.1073280 Oil pressure test rig 595 P3C.1089085 Relief valve, pressure test 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | Test rig, mobile, oil pressure | 1926 |
| 595 P3C.1089085 Relief valve, pressure test 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | - - | 829 |
| 596 PJ.1089086 Gauge adapter, pressure test 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | | 1917 |
| 584 PJ.1089072 Air rig, pressure test 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | | 595 |
| 1231 P3C.862312 Container, LP bearing assembly 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | | 596 |
| 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | | 584 |
| 232 P3C.1065970 Blank, turbo-pump air supply elbow 578 P3C.1089044 Protector, pressure air supply | 102 | | 1231 |
| | 102 | Blank, turbo-pump air supply | |
| | 102 | Protector, pressure air supply | 578 |
| 564 P3C.1089027 Protector, HP rear outer baffle | 103 | Protector, HP rear outer baffle | 564 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC

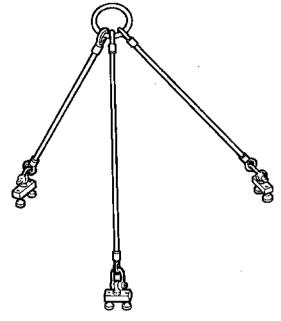
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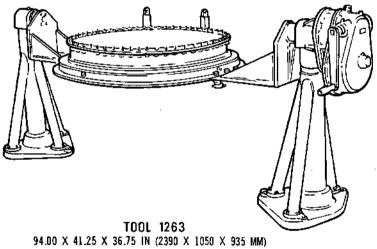
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|-----------------|-----------------------|---|------|
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
| 566 | P3C.1089029 | Protector, distributor transfer tube (vane 6) | 1030 |
| 1927 | AGS.3805/17 | Protector, vent chamber oil drain tube (vane 4) | 1030 |
| 1232 | P3C.862326 | Transport blocks, intermediate case | 1030 |
| 563 | P3C.1089026 | Protector, intermediate case front | 1030 |
| 3060 | P3C.1259755 | Blank (vane 2) | 1031 |
| 3061 | P3C.1259754 | Blank (vanes 3 and 5) | 1031 |
| 3062 | P3C.1259756 | Blank (vane 4) | 1031 |
| 3063 | P3C.1259750 | Pressure test equipment | 1031 |
| *3 064 | P3C.1229397 | Alignment pin, inner case | 1007 |
| *3065 | P3C.1064694 | Assembly/disassembly fixture, inner case | 1008 |
| 3156 | \$3\$20445000 | Seal location lapping kit | 1034 |

Assembly Tools Table 1002 (Concluded)



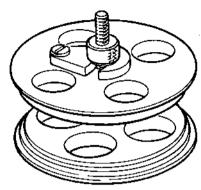


TOOL 1089 31,50 X 35.00 IN DIA (805 X 890 MM)

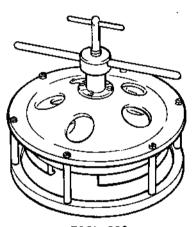




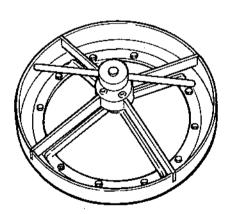
TOOL 1668 5.75 X 2.75 X 0.25 IN DIA (150 X 70 X 10 MM)



TOOL 434 5.00 X 6.00 IN DIA (130 X 155 MM)



TOOL 823 11.75 X 12.00 IN DIA (300 X 305 MM)



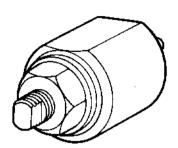
TOOL 932 7.00 X 17.00 IN DIA (180 X 435 MM)

Compressor Intermediate Case - Special Tools Figure 1001

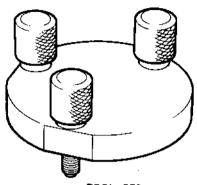
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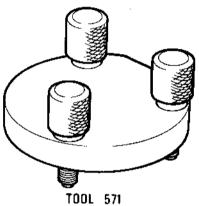
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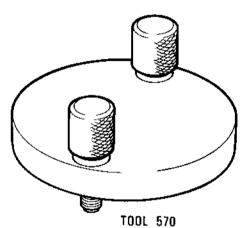
TOOL 959 1.75 X 1.00 IN DIA (45 X 30 MM)



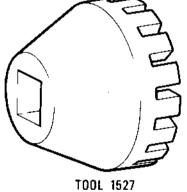
TOOL 572 1.50 X 2.75 IN DIA (40 X 70 MM)



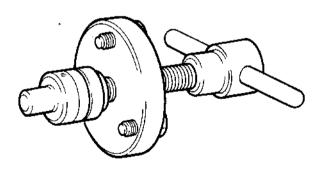
1.50 X 2.75 IN DIA (40 X 70 MM)



1.50 X 3.00 IN DIA (40 X 80 MM)



1.00 X 1.50 (N DIA (30 X 40 MM)



TOOL 341 5.50 X 5.00 X 2.75 IN (140 X 130 X 70 MM)

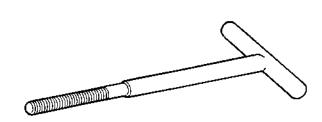
Compressor Intermediate Case - Special Tools Figure 1002

72-32-00

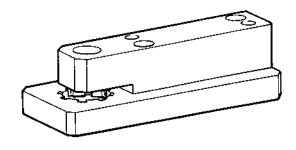
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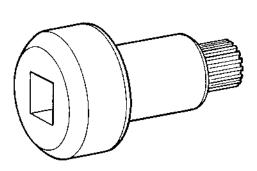




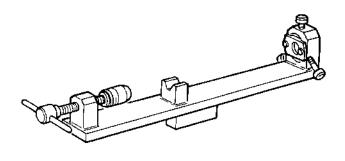


TOOL 177 $_{4.75~\times~2.75~\times~0.25~\text{IN DIA}}$ (125 $\times~70~\times~10~\text{MM})$

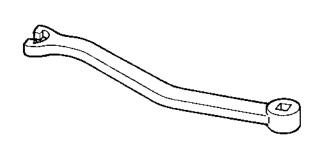




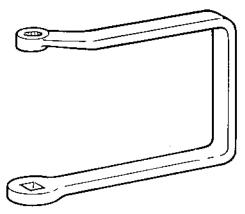
TOOL339 2.75 X 1.50 IN DIA (70 X 40 MM)



TOOL 342 19.75 X 5.75 X 5.00 IN (505 X 150 X 130 MM)



TOOL 1494 8.75 X 1.50 X 1.25 IN (225 X 40 X 35 MM)

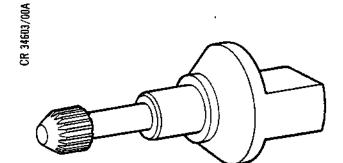


TOOL 1581 $_{\rm 4.00~X~2.50~X~0.75~IN~(105~X~65~X~20~MM)}$

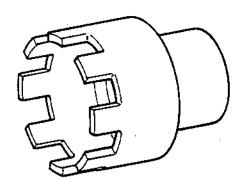
Compressor Intermediate Case - Special Tools Figure 1003

72-32-00

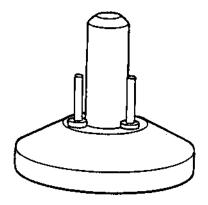
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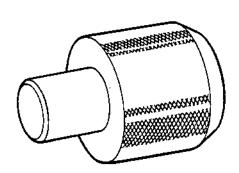
TOOL 356 5.00 X 2.00 IN DIA (130 X 55 MM)



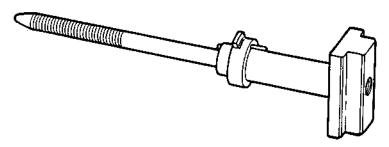
TOOL 1516 1.75 X 1.50 IN DIA (45 X 40 MM)



TOOL 355 3.25 X 3.50 IN DIA (85 X 90 MM)



TOOL 1515 1.75 X 1.00 IN DIA (45 X 30 MM)

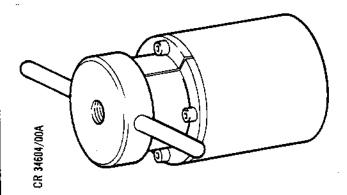


TOOL 353 11.75 X 3.00 X 1.50 (N (300 X 80 X 40 MM))

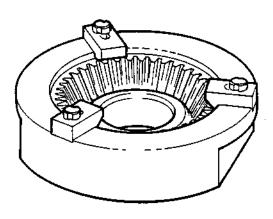
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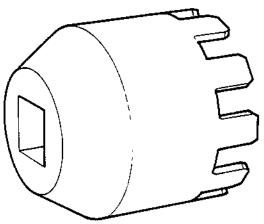




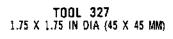
TOOL 352 6.00 X 4.25 X 2.25 IN DIA (155 X 110 X 60 MM)

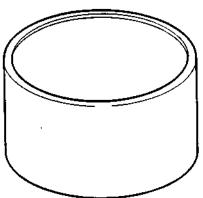


TOOL 256 2.50 X 7.00 IN DIA (65 X 180 MM)



TOOL 623 0.75 X 5.50 IN DIA (20 X 140 MM)

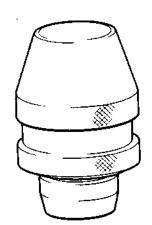




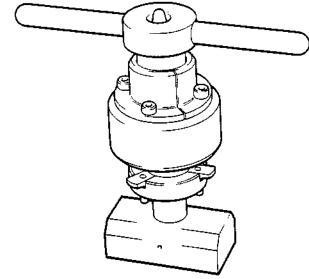
TOOL 622 3.00 X 5.50 IN DIA (80 X 140 MM)

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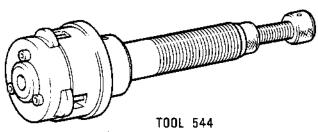
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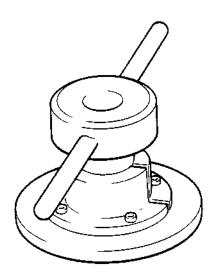
TOOL 630 2.00 X 1.25 IN DIA (55 X 35 MM)

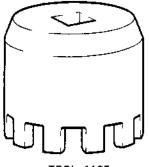


TOOL 701 7.50 X 7.00 X 3.00 !N (195 X 180 X 80 MM)



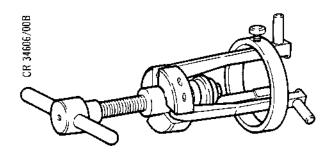
TOOL 544 7.00 X 2.25 IN DIA (180 X 60 MM)





TOOL 1497 1.75 X 2.00 IN DIA (45 X 55 MM)

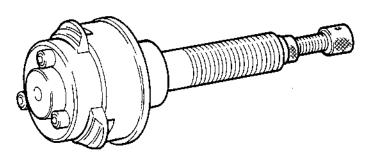
SPECIAL TOOLS ETC.



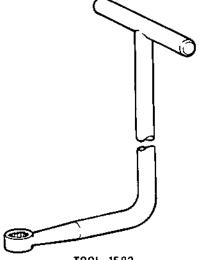
 $\frac{\text{TOOL}}{\text{8.00 X 6.25 X 5.50 IN (205 X 160 X 140 MM)}}$

TOOL 257 9.75 X 6.25 X 4.00 IN (250 X 160 X 105 MM)

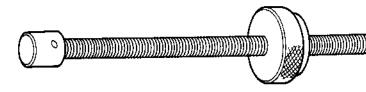
TOOL 3133 8.00 X 6.50 X 4.25 IN (205 X 170 X 110 MM)



TOOL 286 6.50 X 2.50 IN DIA (170 X 65 MM)

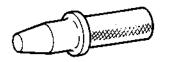


TOOL 1582 9.50 X 3.25 X 3.00 IN (245 X 85 X 80 MM)



TOOL 1805

15.25 X 2.00 IN DIA (390 X 55 MM)



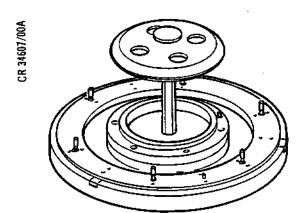
TOOL 3064 2.50 X 0.75 IN DIA (65 X 20 MM)

Compressor Intermediate Case - Special Tools Figure 1007

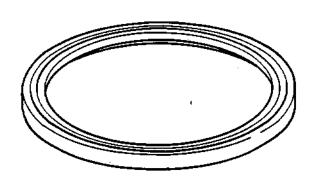
SPECIAL TOOLS ETC

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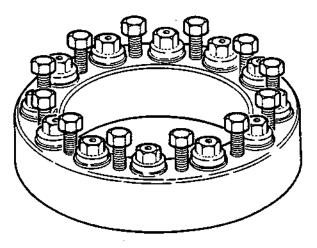
Apr 1/82



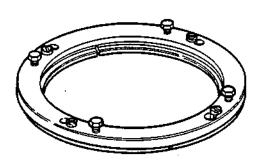
TOOL 3065 12.50 X 22.00 IN DIA (320 X 560 MM)



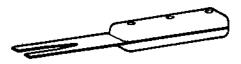
TOOL 851 0.75 X 10.25 IN DIA (20 X 265 MM)



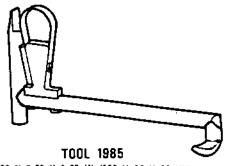
TOOL 897 2.00 X 8.50 (N DIA (55 X 220 MM)



TOOL 828 1.50 X 10.75 IN DIA (40 X 275 MM)



TOOL 1984 7.25 X 1.25 X 0.75 IN (185 X 35 X 20 MM)

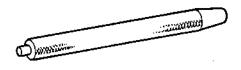


7.00 X 3.50 X 1.25 IN (180 X 90 X 35 MM)

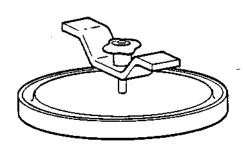
72-32-00



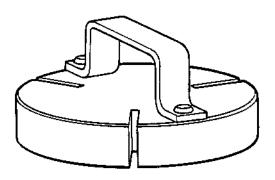
TOOL 1800 TOOL 1801 TOOL 1802 TOOL 1803 6.00 X 0.50 IN DIA (1.55 X 15 MM)



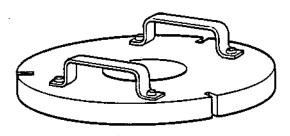
TOOL 1804 6.00 X 0.75 IN DIA (155 X 20 MM)



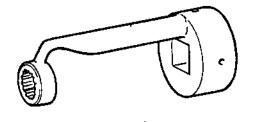
TOOL 1928 4.50 X 11.00 IN DIA (115 X 280 MM)



TOOL 1811 2.50 X 5.50 IN DIA (65 X 140 MM)



TOOL 1812 2.50 X 12.25 IN DIA (65 X 315 MM)

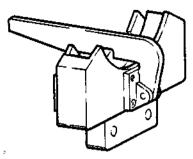


TOOL 1575 2.50 X 1.00 IN DIA (65 X 30 MM)

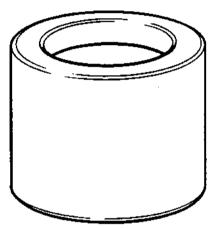
72-32-00
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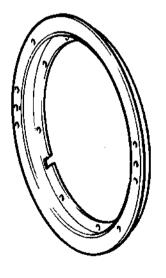
CR 34609/00A



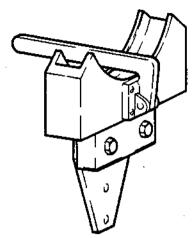
TOOL 1986 825 x 7.75 x 5.25 IN (210 X 200 X 135 MM)



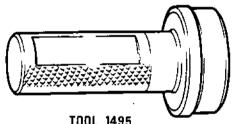
TOOL 254 4.00 X 5.00 IN DIA (105 X 130 MM)



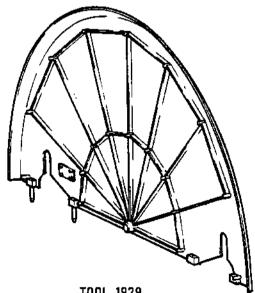
TOOL 1264 2.50 X 42.25 IN DIA(65 X 1075 MM)



TOOL 1987 9.25 X 9.00 X 7.50 IN (235 X 230 X 195 MM)



TOOL 1495 4.75 X 2.50 IN DIA (125 X 65 MM)



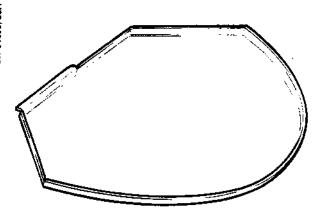
TOOL 1929 102.00 X 55.50 X 2.25 IN (2595 X 1410 X 60 MM)

Compressor Intermediate Case - Special Tools Figure 1010

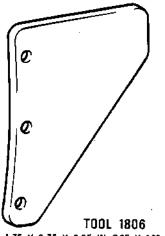
SPECIAL TOOLS ETC.

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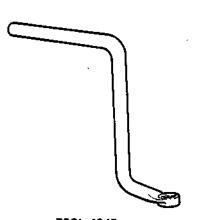
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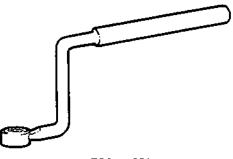
TOOL 1930 91.00 X 49.25 X 2.00 NN (2315 X 1255 X 55 MM)



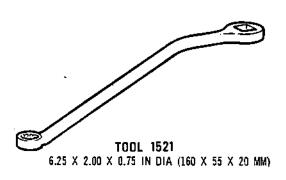
4.75 X 3.75 X 0.25 IN (125 X 100 X 10,00 MM)

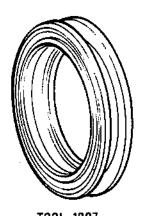


TOOL 1947 $4.00 \times 4.00 \times 0.50 \text{ in dia (105 x 105 x 15 MM)}$



TOOL 1576 5.75 X 2.25 X 0.50 IN DIA (150 X 60 X 15 MM)





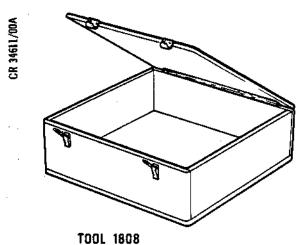
TOOL 1807 2.50 X 8.75 IN DIA (65 X 225 MM)

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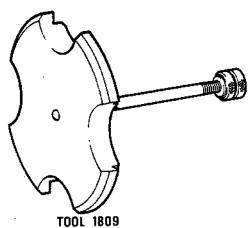
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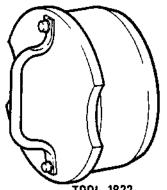




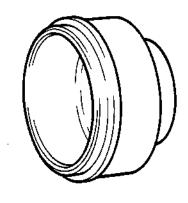
10.25 X 10.00 X 3.00 IN (265 X 255 X 80 MM)



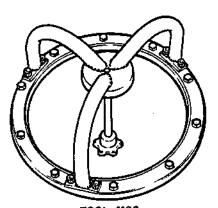
7.25 X 6.75 IN DIA (185 X 175 MM)



TOOL 1822 4.25 X 6.00 IN DIA (110 X 155 MM)

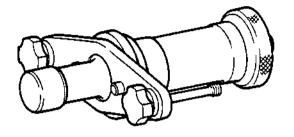


TOOL .81 4.00 X 6.00 IN DIA (155 X 105 MM) TOOL 1810 39.75 X 32.00 X 5.25 IN (1010 X 815 X 135 MM)

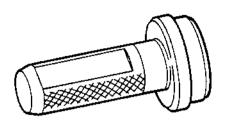


TOOL 1199 10.00 X 12.25 IN DIA (255 X 315 MM)

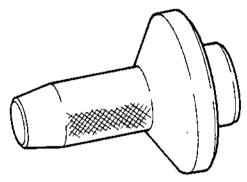
72-32-00
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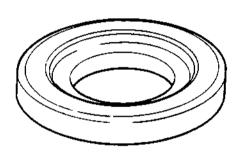
TOOL 56 6.25 X 5.25 X 2.25 IN (160 X 135 X 60 MM)



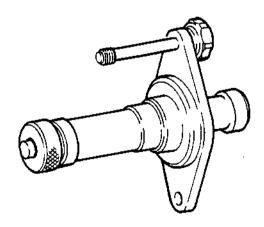
TOOL 324 4.75 X 2.25 IN DIA (125 X 60 MM)



TOOL 620 3.25 X 2.50 IN DIA (85 X 65 MM)



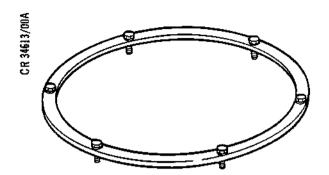
TOOL 621 0.75 X 3.50 IN DIA (20 X 90 MM)



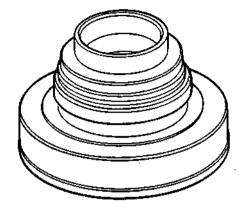
TOOL 40 6.50 X 5.50 X 2.50 IN (165 X 140 X 65 MM)

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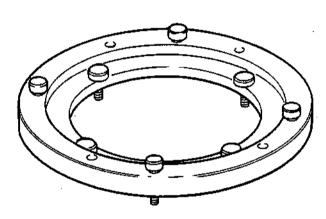




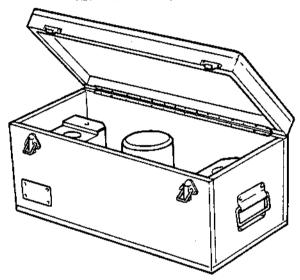
TOOL 251 1.25 X 16.75 IN DIA (35 X 430 MM)



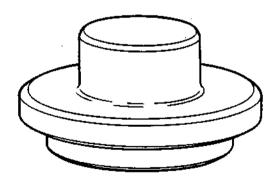
TOOL 1813 5.25 X 8.75 IN DIA (135 X 225 MM)



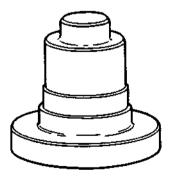
TOOL 253



TOOL 270 15.25 X 9.50 X 7.25 IN (390 X 245 X 185 MM)



TOOL 350 1.00 X 2.00 IN DIA (30 X 55 MM)

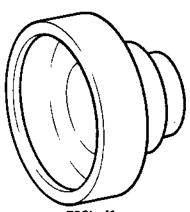


TOOL 351 2.75 x 3.00 IN DIA (70 X 80 MM)

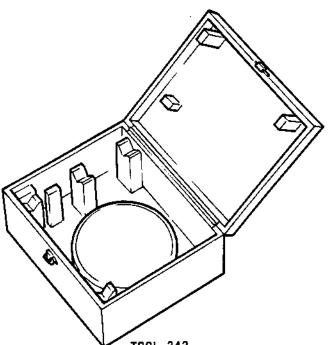
72-32-00



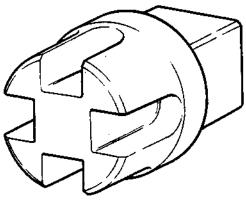




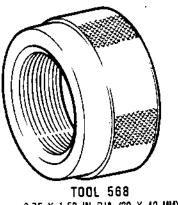
TOOL 41 6.00 X 8.75 IN DIA (155 X 225 MM)



TOOL 343 13.00 X 10.75 X 6.75 IN (335 X 275 X 175 MM)



TOOL 849 1.25 X 0.75 IN DIA (35 X 20 MM)



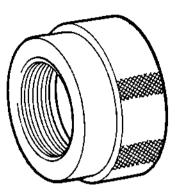
0.75 X 1.50 IN DIA (20 X 40 MM)

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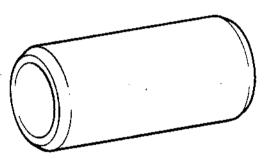
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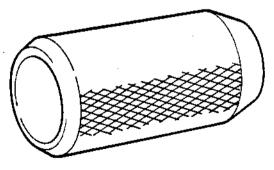
CR 34615/00A



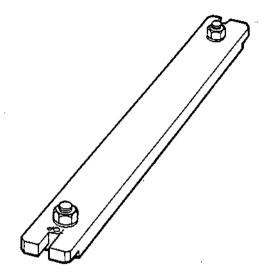
TOOL 1365 0.75 X 1.00 IN DIA (20 X 30 MM)



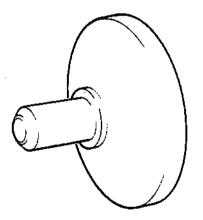
TOOL 1514 3.00 X 1.50 IN DIA ((80 X 40 MM)



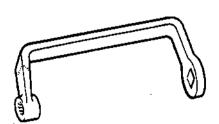
TOOL 1496 4.50 X 2.00 IN DIA (115 X 55 MM)



TOOL 930 16.50 X 1.50 X 1.50 IN (420 X 40 X 40 MM)



TOOL 354 2.50 X 3.50 IN DIA (65 X 90 MM)



TOOL 1629 4.00 X 2.00 X 0.75 IN (105 X 55 X 20 MM)

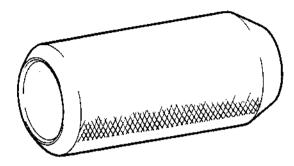
Compressor Intermediate Case - Special Tools Figure 1016

SPECIAL TOOLS ETC.

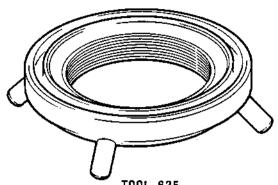
/2-32-00 Page 1025 Aug 1/78



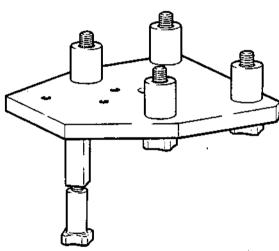
CR 34616/00A



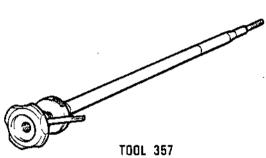
TOOL 323 4.25 X 1.75 IN DIA (110 X 45 MM)



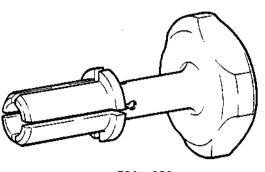
TOOL 635 1.00 X 7.00 IN DIA (30 X 180 MM)



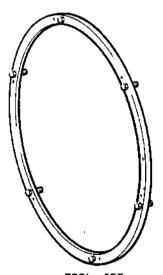
TOOL 359 6.00 X 5.50 X 5.50 IN (155 X 140 X 140 MM)



18.50 X 3.50 X 2.00 IN OIA (470 X 90 X 55 MM)



TOOL 358 3.50 X 2.00 IN DIA (90 X 55 MM)



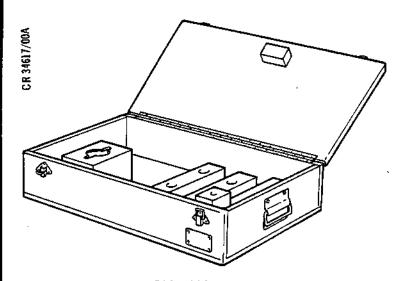
TOOL 250 1.25 X 19.00 IN DIA (35 X 485 MM)

Compressor Intermediate Case - Special Tools Figure 1017

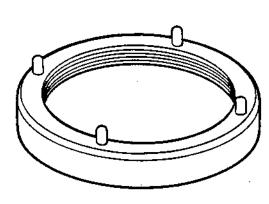
SPECIAL TOOLS ETC.

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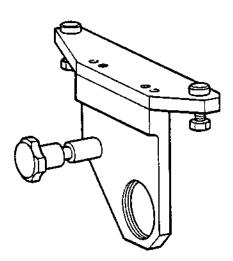




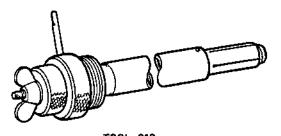
TOOL 360 20.50 X 9.75 X 4.50 IN (525 X 250 X 115 MM)



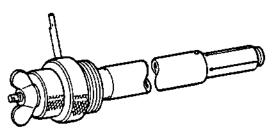
TODL 960 1.50 X 6.25 IN DIA (40 X 160 MM)



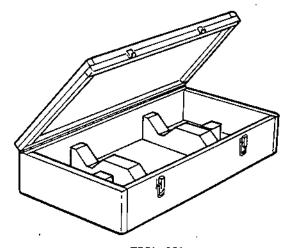
TOOL 617 7,75 x 4.75 x 4.00 IN (200 x 125 x 105 MM)



TOOL 618 15.00 X 3.75 X 1.75 IN (385 X 100 X 45 MM)



TOOL 619 14.00 X 3.75 X 1.75 IN (360 X 100 X 45)

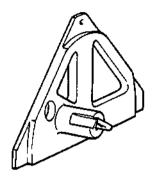


TOOL 631 16.50 X 6.75 X 3.50 IN (420 X 175 X 90 MM)

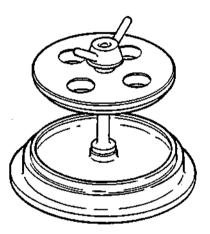
72-32-00

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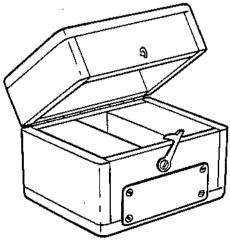




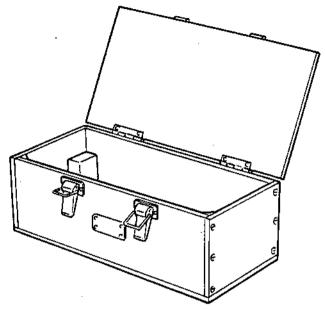
TOOL 21 12.50 X 6.75 X 4.00 IN (320 X 175 X 105 MM)



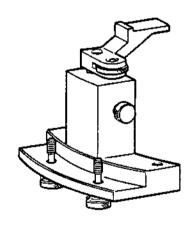
TOOL 826 7.00 X 7.00 IN DIA (180 X 180 MM)



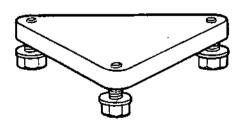
TOOL 825 5.00 X 4.75 X 4.25 IN (130 X 125 X 110 MM)



TOOL 263 13.50 X 7.75 X 525 IN (345 X 200 X 135 MM)



TOOL 44 4.25 X 4.00 X 3.25 IN (110 X 105 X 85 MM)



TOOL 433 3.50 x 3.50 x 1.00 IN (90 x 90 x 30 MM)

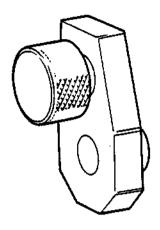
SPECIAL TOOLS ETC.

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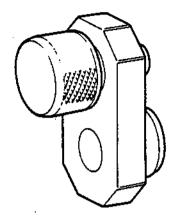
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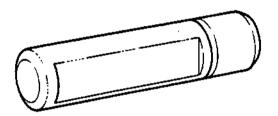
TOOL 1814 1.50 X 1.00 X 1.00 IN (40 X 30 X 30 MM)



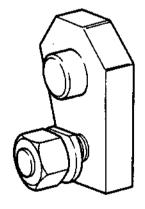
TOOL 1815 1.50 X 1.00 X 0.75 IN (40 X 30 X 20 MM)



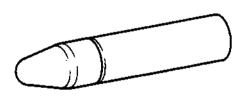
TOOL 1816 1.00 x 0.75 in DIA (30 x 20 MM)



TOOL 565 2.25 X 0.75 IN DIA (60 X 15 MM)



TOOL 1817 1.50 X 1.00 X 0.75 IN (40 X 30 X 20 MM)



TOOL 1507 1.75 X 0.50 IN DIA (45 X 15 MM)

SPECIAL TOOLS ETC.

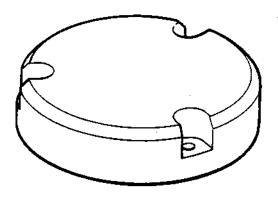
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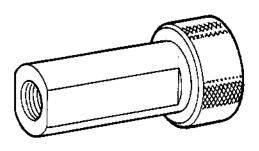




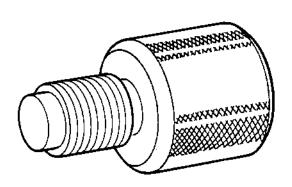
TOOL 553 7.50 X 1.00 X 0.25 IN (195 X 30 X 0.25 MM)



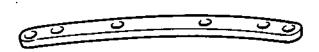
TOOL 576 1.25 X 5.25 IN DIA (35 X 135 MM)



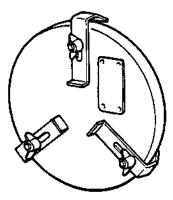
TOOL 577 1.50 X 0.75 IN DIA (40 X 20 MM)



TOOL 436 1.50 X 0.75 IN DIA (40 X 20 MM)

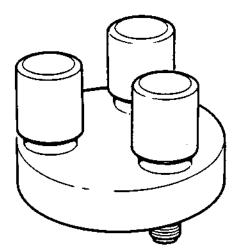


TOOL 1561 7.50 x 1.00 x 0.25 IN (195 x 30 x 10 MM)

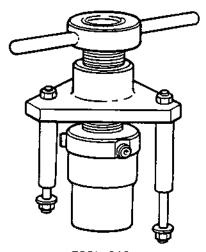


TOOL 702 1.75 X 7.50 IN DIA (45 X 195 MM)

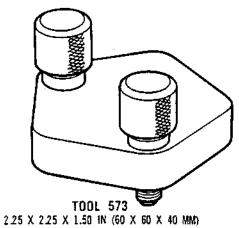
SPECIAL TOOLS ETC. Page 1030 Aug 1/78



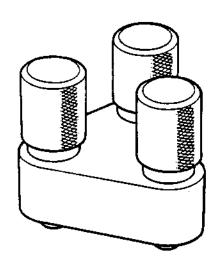
TOOL 569 1.00 X 1.75 IN DIA (30 X 45 MM)



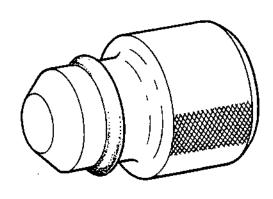
TOOL 340 6.00 X 6.00 X 4.25 IN (155 X 155 X 110 MM)



TOOL 337 1.00 X 3.50 IN DIA (30 X 90 MM)



TOOL 574 1,75 x 1.50 X 1.50 IN (45 X 40 X 40 MM)



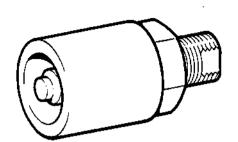
TOOL 399 1.25 X 0.75 IN DIA (35 X 20 MM)

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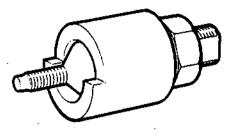
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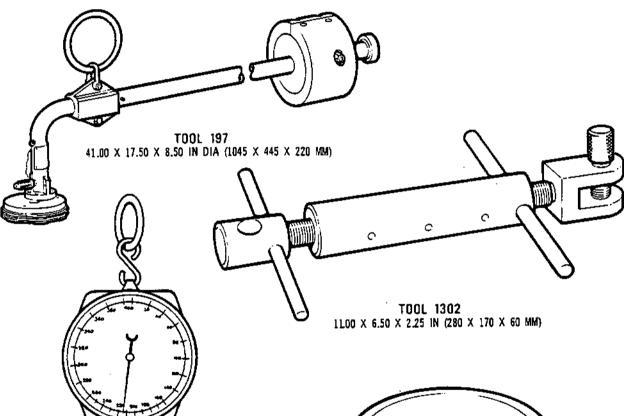




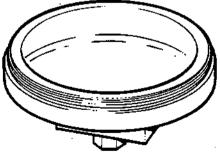
TOOL 957 1.25 X 0.75 IN DIA (35 X 20 MM)



TOOL 958 1.75 X 0.75 IN DIA (45 X 20 MM)



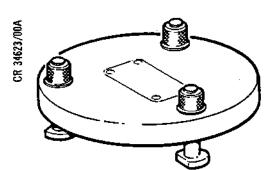
TOOL 1631 26,00 X 11.00 X 2.50 IN (665 X 280 X 65 MM)



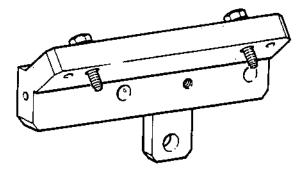
TOOL 1934 3.50 X 6.75 IN DIA (90 X 175 MM)

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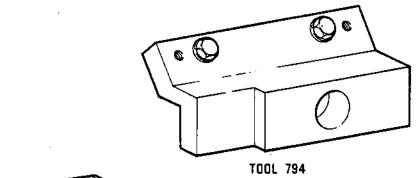
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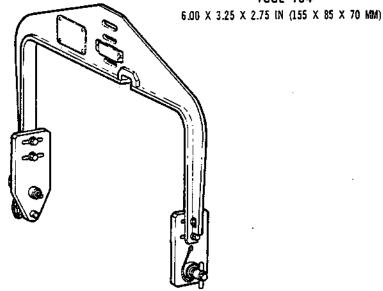


TOOL 199 1.75 X 5.25 IN DIA (45 X 135 MM)

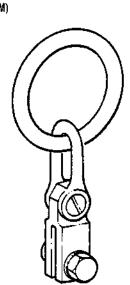


TOOL 793 7.50 X 4.50 X 2.75 IN (195 X 115 X 70 MM)





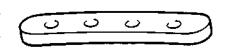
TOOL 795 33.00 X 24.00 X 3.50 IN (840 X 610 X 90 MM)



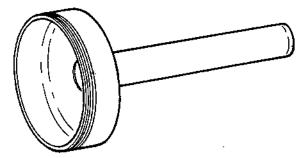
TOOL 827 7.75 X 5.25 X 2.25 IN (200 X 135 X 60 MM)

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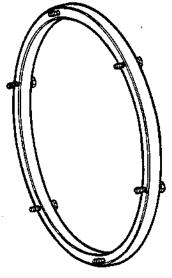
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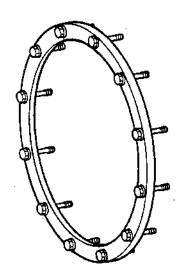
TOOL 562 $_{\rm 4.00~X~0.75~X~0.25~IN~(105~X~20~X~10~MM)}$



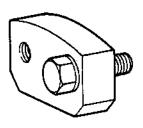
TOOL 785 13.75 X 7.25 IN DIA (350 X 185 MM)



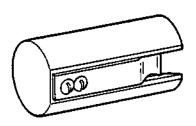
TOOL 249 1.75 X 14.00 (N DIA (45 X 360 MM)



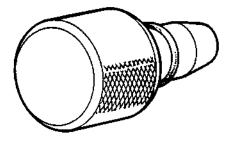
. TOOL 252 1.75 X 12.50 IN DIA (45 X 320 MM)



TOOL 1915 TOOL 1916 2.00 X 1.25 X 1.00 N (55 X 35 X 30 MM)



TOOL 1932 1.75 X 1.00 IN DIA (45 X 30 MM)



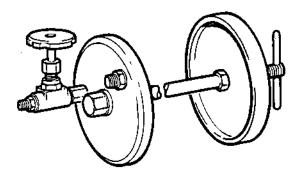
TOOL:432 1.75 X 0.75 IN DIA (45 X 20 MM)

SPECIAL TOOLS ETC.

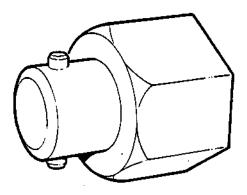
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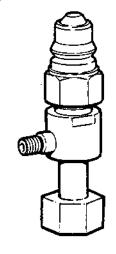
CR 34625/00A



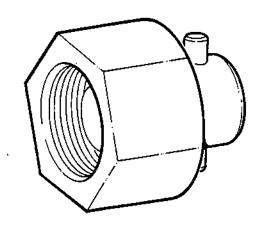
TOOL 1820 22.00 X 8.00 X 6.75 IN (560 X 205 X 175 MM)



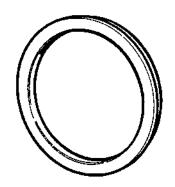
TOOL 616 1.00 X 1.00 IN DIA (30 X 30 MM)



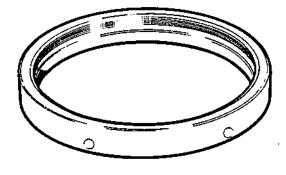
TOOL 1819 5.25 X 2.00 X 1.25 IN (I35 X 55 X 35 MM)



TOOL 441 1.00 X 1.00 IN DIA (30 X 30 MM)



TOOL 439 0.75 X 7.00 IN DIA (20 X 180 MM)



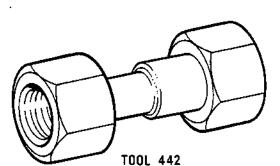
TOOL 690 1.00 X 7.75 IN DIA (30 X 200 MM)

Compressor Intermediate Case - Special Tools Figure 1026

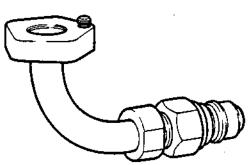
SPECIAL TOOLS ETC.

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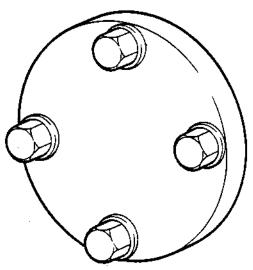
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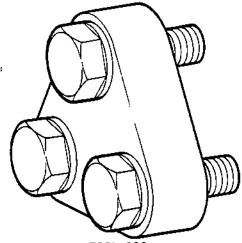
2.00 X 0.75 IN DIA (55 X 20 MM)



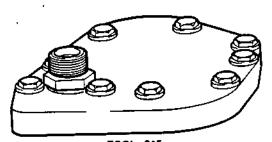
TOOL 1821 6.50 X 2.25 X 2.25 IN (170 X 60 X60 MM)



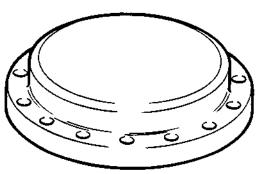
TOOL 816 1.25 X 3.00 IN DIA (35 X 80 MM)



TOOL 689 1.75 X 1.50 X 1.25 IN (45 X 40 X 35 MM)

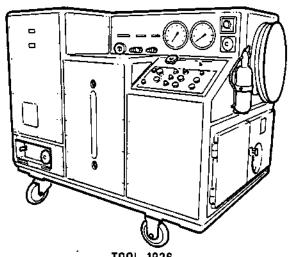


TOOL 815 6.00 X 6.00 X 1.75 IN (155 X 155 X 45 MM)

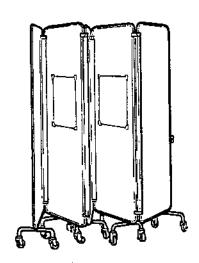


TOOL 892 1.50 X 5.25 IN DIA (40 X 135 MM)

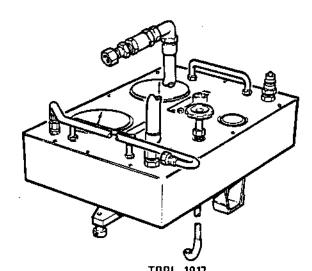
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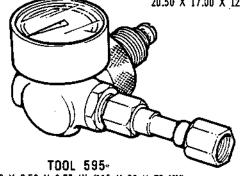
TOOL 1926 71.00 X 57.00 X 45.00 IN (1805 X 1550 X 1145 MM)



TOOL 829 86.50 X 41.00 X 23.50 IN (2200 X 1045 X 600 MM)



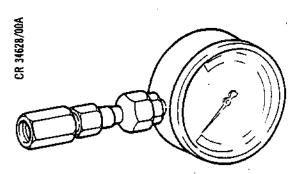
TOOL 1917 20.50 X 17.00 X 12.25 1N (525 X 435 X 315 MM)



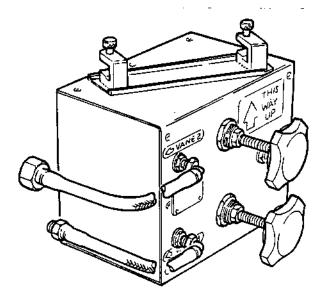
TOOL 595-4.50 X 3.50 X 2.75 IN (115 X 90 X 70 MM)

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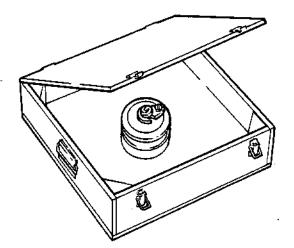
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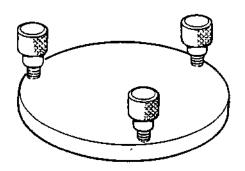
TOOL 596 5.50 X 2.25 X 1.50 IN (140 X 50 X 35 MM)



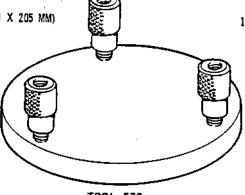
TOOL 584 10.75 X 9.50 X 9.00 IN (275 X 245 X 230 MM)



TOOL 1231 22.25 X 22.00 X 8.00 IN (570 X 560 X 205 MM)



TOOL 232 1.50 X 4.50 IN DIA (35 X 115 MM)



· TOOL 578 1.50 X 4.00 IN DIA (35 X 100 MM)

SPECIAL TOOLS ETC.

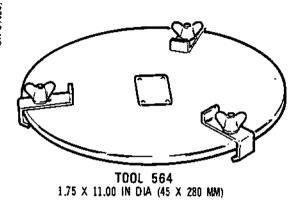
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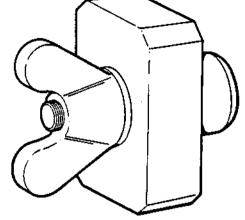
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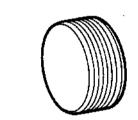


CR 34629/00A

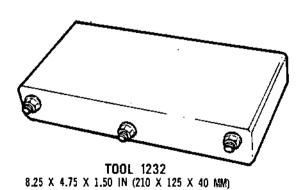


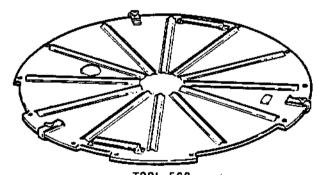


TOOL 566 1.50 X 1.25 X 1.00 IN (40 X 35 X 30 MM)



TOOL 1927 0.75 X 1.25 IN DIA (20 X 35 MM)





TOOL 563 2.00 X 36.25 IN DIA (55 X 925 MM)

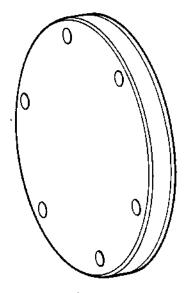
Compressor Intermediate Case - Special Tools Figure 1030

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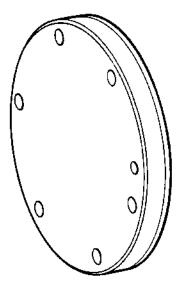
Page 1039 Aug 1/78



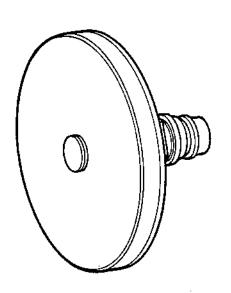




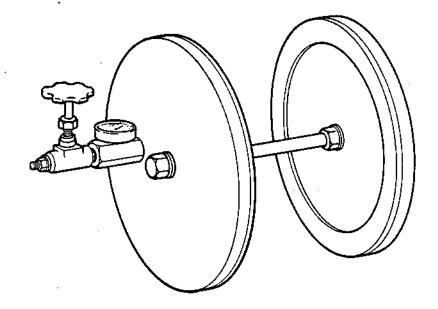
TOOL 3060 0.75 X 4.50 IN DIA (20 X 115 MM)



TOOL 3061 0.75 X 5.00 IN DIA (20 X 130 MM)



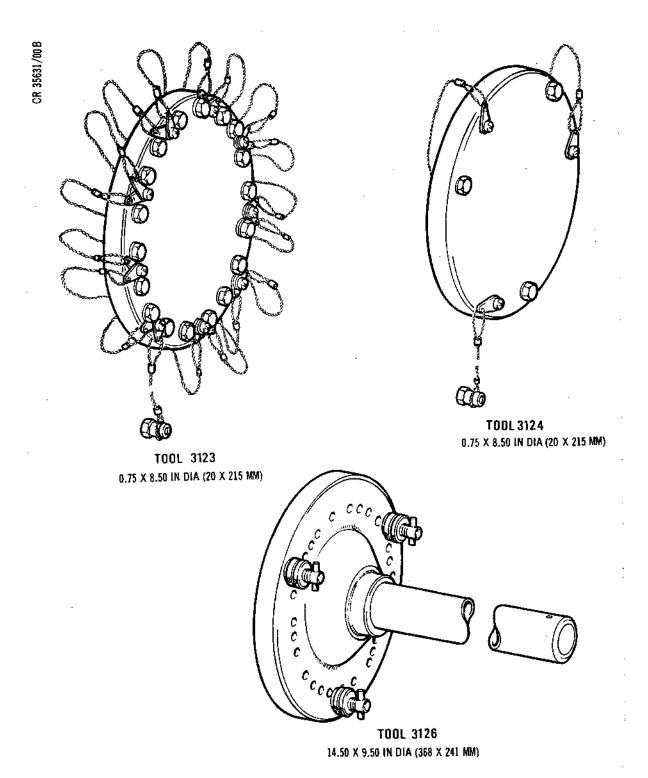
TOOL 3062 3.25 X 5.75 IN DIA (85 X 150 MM)



TOOL 3063 17.00 X 12.50 IN DIA (435 X 320 MM)

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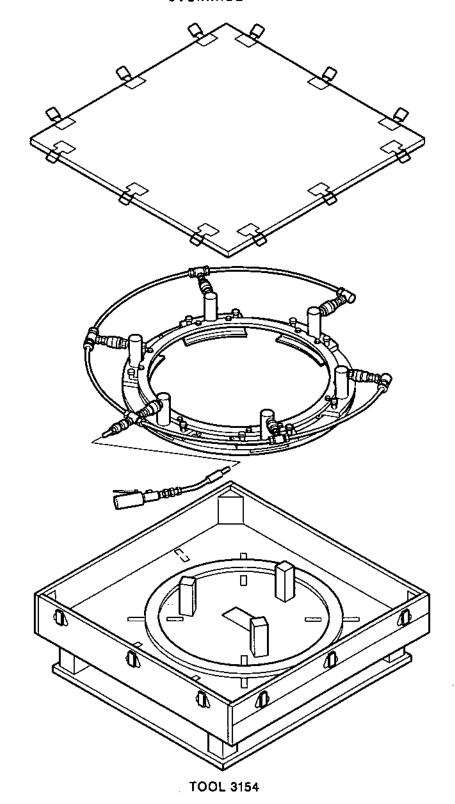




SPECIAL TOOLS ETC

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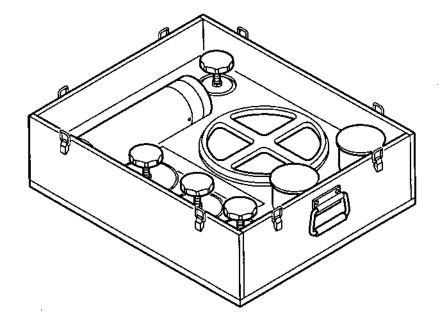


Compressor Intermediate Case - Special Tools Figure 1033

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TOOL 3156

Compressor Intermediate Case - Special Tools Figure 1034

SPECIAL TOOLS ETC

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HP COMPRESSOR ASSEMBLY - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001, 1002 and 1003 are those required to check balance the assembly (if required), remove the intermediate case, and disassemble the HP compressor assembly. Table 1004 lists the tools etc. required to assemble the HP compressor, whilst Table 1005 lists those required to check concentricity, swash and balance. Table 1006 lists the tools etc. required to assemble, balance and disassemble the HP turbine from the HP compressor, Table 1007 lists tools required for assembly and disassembly of the HP turbine simulator and Table 1008 lists those required to assemble the intermediate case to the HP compressor.
- B. The tools have been listed in order of usage, and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul and will be duplicated in the tables. The items of tooling with ** are alternatives to those mentioned in the text and are not shown in the accompanying illustrations.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. HP Compressor Check Balance Tools

NOTE: The special tools etc. listed in Table 1001 are those required if a check balance of the assembly is required prior to disassembly. On completion of the check balance, refer to Table 1003 for the disassembly tools etc.



| TOOL | MANUFACTURER | • | FIG. |
|---------|---------------|--|------------|
| REF.NO. | PART NO. | DESCRIPTION | NO. |
| *1036 | P3C.695712 | Mobile stand, HP compressor/ | 100 |
| *1043 | P3C.695727 | intermediate case | 100 |
| *1043 | P3C.695701 | Lifting fixture, HP compressor Pit stand, HP compressor | 100 |
| *1042 | P3C.695726 | Nut, sleeve, LP drive shaft | 100 100 |
| *1058 | P3C.695743 | Split sleeve, HP/LP drive shaft | 100 |
| * 377 | P3C.1083264 | Guide sleeve, LP drive shaft | 100 |
| *1031 | P3C.695706 | Support sleeve, HP drive shaft/ compressor | 100 |
| *1029 | P3C.695703 | Mechanical jack, HP drive shaft/ compressor | 100 |
| *1030 | P3C.695705 | Support sleeve, HP drive shaft/ compressor | 100 |
| * 396 | P3C.1083282 | Support steady, LP drive shaft | 100 |
| *1962 | P5J.1294422 | Mechanical puller, static seal housing | 100 |
| * 427 | P3C.1083384 | Protector, LP drive shaft | 100 |
| *1523 | P3C.1247000 | Pliers, front bearing retaining nut locking washer | 100 |
| * 397 | P5J.1083283 | Steady, spanner wrench (386) | 100 |
| * 387 | P3C.1083270 | Immobilizer, HP rotor shaft front | 100 |
| *1022 | P3C.684642 | Multiplier, spanner wrench (386) | 100 |
| * 386 | P3C.1083269 | Spanner wrench, HP compressor bearing | 100 |
| *1324 | PJ.892959 | Spanner wrench, front bearing | 100 |
| | **P3C.1089500 | retaining nut | |
| * 411 | P3C.1083361 | Lifting/extracting fixture, intermediate case | 100 |
| *1232 | P3C.862326 | Transport blocks, intermediate case | 100 |
| *1246 | P3C.863651 | Protector, HP compressor, front end | 100 |
| *1289 | P3C.867499 | Bearing, slave, front bearing adapter (1032) | 100 |
| *1032 | P3C.695708 | Front bearing adapter, HP compressor | 100 |
| *1353 | P3C.899007 | Lifting/extracting fixture, front bearing adapter (1032) | 100 |

Check Balancing Tools Table 1001 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| * 288 | P3C,1073111 | Steady, HP rotor shaft front | 1005 |
| * 870 | P3C.1263663 | Spacer ring, HP rotor shaft front | 1005 |
| * 891 | P3C.1262603 | Adapter, mechanical driver (900) | 1005 |
| * 521 | P5J.1264682 | Extension, part of driver (900) | 1005 |
| | **P3C.1234501 | . , , | |
| * 900 | P3C.1223020 | Mechanical driver, hydraulic, slave bearing assembly | 1005 |
| * 988 | PJ.1234509 | Spacer ring, HP rotor shaft front | 1006 |
| *1158 | P3C.850969 | Steady, front bearing adapter (1032) | 1006 |
| 1656 | T.512900 | Torquemeter wrench | 1006 |
| *1339 | P3C.896939 | Immobilizer, HP rotor shaft front | 1006 |
| * 290 | P3C.1073114 | Steady, LP drive shaft front | 1006 |
| * 292 | P3C.1073116 | Support, LP drive shaft front | 1006 |
| *1340 | P3C.896940 | Knurled nuts, immobilizer (1339) | 1006 |
| * 291 | P3C.1073115 | Locking nut, steady (290) | 100 |
| * 395 | P3C.1083281 | Protector, HP compressor case blow-off aperture | 100 |
| * 394 | P3C.1083280 | Protector, HP compressor case vent aperture | 100 |
| *1341 | P3C.896941 | Knurled headed bolts, immobilizer (1339) | 100 |
| *1315 | P3C.892955 | Adapter, immobilizer (1343) | 100 |
| *1343 | P3C.896945 | Immobilizer, HP hub/drive shaft | 100 |
| * 334 | P3C.1076074 | Lifting ring, spanner (1085) | 100 |
| *1085 | P3C.695770 | Spanner wrench, HP hub nut | 100 |
| *1342 | P3C.896944 | Torque loading arm, HP hub nut | 100 |
| *1344 | P3C.896946 | Weight carrier, torque loading arm (1342) | 100 |
| *1345 | P3C.896947 | Weight, torque loading arm (1342) | 100 |
| 1658 | T.520387 | Torquemeter wrench | 100 |
| *1120 | P3C.699964 | Lifting fixture, HP turbine wheel | 100 |

Check Balancing Tools Table 1001 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| * 393 | P3C.1083279 | Split sleeve, LP drive shaft/HP rear labyrinth | 1008 |
| *1062 | P3C.695747 | Protector, HP turbine hub labyrinth | 1009 |
| ×1061 | P3C.695746 | Protector, HP turbine rear labyrinth | 1009 |
| *1063 | P3C.695748 | Protector, HP turbine front labyrinth | 1009 |
| *1126 | P3C.699970 | Protection band, HP turbine blades | 1009 |
| * 1075 | P3C-695765 | Spacer, support (1073), HP compressor | 1009 |
| *1074 | P3C.695764 | Spacer, support (1073), HP compressor | 1009 |
| *1090 | P3C.695799 | Adjustable support, LP drive shaft | 1010 |
| *1291 | PJ.867097 | Bracket, guard (1303) | 1010 |
| *1303 | P3C.869283 | Guard, protection, HP turbine wheel | 1010 |
| *1056 | P30.695739 | Beam type sling, HP compressor | 1010 |
| *1394 | PJ.899274 | Single leg sling, sling (1056), HP compressor | 1010 |
| *1076 | P3C.695766 | Front support, HP compressor | 1010 |
| *1306 | P3C.871923 | Rear support, HP compressor | 1011 |
| *1292 | PJ.867803 | Tie bar, balancing machine | 1011 |
| *1293 | PJ.867804 | Tie bar, balancing machine | 1011 |
| *1073 | P3C.695763 | Support, HP compressor | 1011 |
| *1059 | P3C.695744 | Jack, LP drive shaft support | 1011 |
| * 1 | P3C.1050066 | Checking gauge, HP compressor concentricity check | 1011 |
| * 90 | P3C.1050050 | Container, checking gauge (1 and 2) | 1012 |
| * 2 | P3C.1050067 | Checking gauge, HP compressor concentricity check | 1017 |
| *1247 | P3C.1263649 | Mechanical puller, HP turbine | 1012 |
| | **PJ.863652 | rear labyrinth | |
| * 1111 | P3C.699961 | Mobile stand, HP turbine wheel | 1012 |
| * 139 | P3C.699962 | Mandrel, HP turbine wheel | 1017 |
| *1113 | P30.699963 | Lifting fixture, mandrel (139) | 1012 |
| *1057 | P3C.695740 | Extractor/lifting fixture, HP turbine hub | 1013 |

Check Balancing Tools Table 1001 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---|-------------|
| * 414 | P3C.1083358 | Spacer ring, HP drive shaft | 1013 |
| * 410 | P3C.1083360 | Spanner wrench, rear bearing retaining nut | 1013 |
| 212 | PJ.1065902 | Tie bar, balancing machine | 1013 |
| *1054 | P3C.695736 | Multiple leg sling, rear bearing adaper (1028) | 1013 |
| *1543 | P3C.1244614 | Cranked ring wrench HP drive shaft labyrinth nuts | 1014 |
| *3141 | \$3\$14842000 | Cranked ring wrench, HP drive shaft labyrinth nuts | 1013 |
| 1668 | T.914825 | Puller, HP drive shaft labyrinth (Pre.SB.OL.72-8305-154 standard engines) | 1014 |
| 3154 | \$3\$20077000 | Hydraulic extractor (Pre. and Post SB.OL.72- 8305-154 standard engines) | 1040 |
| *1239 | P3C_862841 | Protector HP drive shaft labyrinth | 1014 |
| *1051 | P3C.695730 | Beam type sling, adapter (1041) | 1014 |
| 1041 | P3C.695724 | Rear bearing adapter, HP compressor | 1014 |
| * 391 | P3C.1083275 | Spacer sleeve, LP drive shaft | 1014 |
| 914 | PJ.1223052 | Lifting fixture, HP compressor | 1015 |
| * 403 | P3C.1083349 | Protector, LP drive support sleeve (1031) | 1015 |
| *1050 | P3C.695729 | Container, LP/HP drive shaft | 1015 |
| *1040 | P3C.695723 | Stand, disassembly, HP compressor | 1015 |
| *1233 | PJ.862332 | Platform, HP compressor stand (1040) | 1015 |

Check Balancing Tools Table 1001 (Concluded)

3. Intermediate Case Assembly Removal Tools

NOTE: On receipt of the HP compressor/intermediate case assembly from bulk engine disassembly, remove the intermediate case assembly and prepare the HP compressor assembly for disassembly, using the special tools etc. listed in Table 1002. If a check balance of the assembly is required, the tooling listed in Table 1002 will not be required as the tooling is covered by Table 1001.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| *1043 | P3C.695727 | Lifting fixture, HP compressor | 1001 |
| * 391 | P3C.1083275 | Spacer sleeve, LP drive shaft | 1014 |
| *1042 | P3C.695726 | Nut, slave, LP drive shaft | 1001 |
| * 1058 | P3C.695743 | Split sleeve, HP/LP drve shaft | 1001 |
| *1036 | P3C.695712 | Mobile stand, HP compressor/ | 1001 |
| 4 | **P3C.896948 | intermediate case | |
| 1039 | P30.695720 | Lifting fixture, HP compressor | 1016 |
| * 403 | P3C.1083349 | Protector, LP drive support sleeve (1031) | 1015 |
| *1050 | P30.695729 | Container, LP/HP drive shaft | 1015 |
| * 1040 | P3C.695723 | Stand, disassembly, HP compressor | 1015 |
| * 1233 | PJ.862332 | Platform, HP compressor stand (1040) | 1015 |
| * 396 | P3C.1083282 | Support steady, LP drive shaft | 1002 |
| *1962 | P5J.1294422 | Mechanical puller, static seal housing | 1002 |
| * 427 | PJ.1083384 | Protector, LP drive shaft | 1003 |
| *1523 | P3C.1247000 | Pliers, front bearing retaining nut locking washer | 1003 |
| * 397 | P3C.1083283 | Steady, spanner wrench (386) | 1003 |
| * 387 | P3C.1083270 | Immobilizer, HP rotor shaft front | 1003 |
| *1022` | P3C.684642 | Multiplier, spanner wrench (386) | 1003 |
| * 386 | P30.1083269 | Spanner wrench, HP compressor bearing | 1003 |
| *1324 | PJ.892959 | Spanner wrench, front bearing | 1004 |
| | **P3C.1089500 | retaining nut | |
| * 411 | P3C.1083361 | <pre>Lifting/extracting fixture, intermediate case</pre> | 1004 |
| *1232 | PJ.862326 | Transport blocks, intermediate case | 1004 |
| *1246 | P3C.863651 | Protector, HP compressor front end | 1004 |

Intermediate Case Removal Tools.
Table 1002 (Concluded)

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4. HP Compressor Disassembly Tools

NOTE: The special tools etc. listed in Table 1003 are those required to disassemble the HP compressor assembly upon completion of the check balance (if required), or removal of the intermediate case assembly.

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---|-------------|
| *1246 | P30.863651 | Protector, HP compressor, front end | 1004 |
| 1522 | P3C.1083363 | Universal socket wrench, HP compressor disk/spacer bolts | 1016 |
| 1225 | P30.862330 | Driver, HP compressor disk/ spacer bolts | 1016 |
| * 404 | P3C.1083350 | Multiple leg sling, HP compressor disks stage 1 to 6 | 1016 |
| 1130 | P3C.699974 | Protector/retaining band, HP compressor blades | 1016 |
| *1364 | PJ.898007 | Protector, wooden, stator vanes/ blades | 1017 |
| 1391 | P5H.1255614 | Platform, container (1374) | 1017 |
| 1374 | POJ.1077505 | Container, HP compressor stator vanes stage 1 to 3 | 1017 |
| *1441 | POJ.868965 | Container, cleaning/storage, HP spacers/inner fixing rings | 1017 |
| * 392 | P3C.1083278 | Protector, HP rotor shaft front labyrinth | 1017 |
| 1591 | P3C.69579D | Cranked ring wrench, HP rotor shaft | 1017 |
| 457 | P3C.1086801 | Mechanical puller, HP rotor shaft front/stage 2-3 spacer ring | 1018 |
| 459 | P3C.1086803 | Bolts, slave, mechanical puller (457) | 1018 |
| 458 | P3C.1086802 | Thrust bolts, mechanical puller (457) | 1018 |
| *1645 | PT.251081 | Multiple leg sling, mechanical pullers | 1018 |

Disassembly Tools
Table 1003 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| * 388 | P3C.1083272 | Lifting fixture, HP rotor shaft front | 1018 |
| *1420 | POJ.868934 | Container, cleaning/storage, HP rotor shaft front | 1018 |
| * 287 | P3C.1073110 | Steady, LP drive shaft front | 1019 |
| 461 | P3C.1086805 | Mechanical puller, HP compressor stage 2 disk | 1019 |
| 462 | P3C.1086806 | Claw, mechanical puller (461) | 1019 |
| . 460 | P3C.1086804 | Bolts, slave, mechanical puller (457) | 1019 |
| 933 | P3C.1229301 | Protector, stage 2-3 spacer ring labyrinth | 1019 |
| 463 | P3C.1244772 | Mechanical puller, HP compressor stage 3 disk | 1019 |
| 464 | P3C.1086808 | Claw, mechanical puller (463) | 1020 |
| *1166 | PJ.857325 | Retainer strap, compressor blades | 1020 |
| | **PJ.1259776 | | |
| 1390 | P3C.861891 | Platforms, containers (1374 and 1373) | 1020 |
| *1361 | PJ.898010 | Protector, wooden, stator vanes/ blades | 1020 |
| 1611 | P3C.863628 | Driver, HP compressor disk/ spacer bolts | 1020 |
| 471 | P3C.1244700 | Mechanical puller, stage 3-4 spacer ring | 1020 |
| 475 | P3C.1086819 | Bolts, slave, mechanical puller (471, 472, 473) | 1021 |
| 474 | P3C.1086818 | Securing pins, mechanical puller (471, 472, 473) | 1021 |
| 465 | P3C.1244696 | Mechanical puller, HP compressor stage 4 disk | 1021 |
| 466 | P3C.1086810 | Claw, mechanical puller (465) | 1021 |
| 1373 | РОЈ.1077504 | Container, HP compressor stator vanes stage 4 to 6 and exit guide vanes | 1021 |
| *1360 | PJ.898011 | Protector, wooden, stator vanes/ blades | 1021 |

Disassembly Tools Table 1003 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| | | | |
| 472 | P3C.1244694 | Mechanical puller, stage 4-5 spacer ring | 1023 |
| 467 | \$38.20359000 | Mechanical puller, HP compressor stage 5 disk | 102 |
| 468 | P3C.1086812 | Claw, mechanical puller (467) | 102 |
| *1053 | PJ.695734 | Multiple leg sling, HP compressor front case | 1027 |
| *1359 | PJ.898012 | Protector, wooden, exit guide/ stator vanes/blades | 102 |
| 473 | P3C.1244698 | Mechanical puller, stage 5-6 spacer ring | 102 |
| 469 | P3C.1086813 | Mechanical puller, HP compressor stage 6 disk | 102 |
| * 1517 | P3C.1244664 | Crank ring wrench, stage 6-7 spacer ring bolts | 102 |
| 818 | P3C.1089497 | Socket wrench, stage 6-7 spacer ring bolts | 102 |
| 762 | P3C.1089393 | Driver, stage 6-7 spacer ring bolts | 102 |
| 1544 | P3C.1094769 | Cranked ring wrench, stage 6-7 spacer ring bolts | 102 |
| 1619 | P3C.871927 | Socket wrench, stage 6-7 spacer ring bolts | 102 |
| 470 | PJ.1086814 | Puller, stage 6-7 spacer ring | 102 |
| | **P3C.1244697 | | |
| *1065 | P3C.695750 | Assembly pin, short, HP compressor disk/spacer bolts | |
| *1067 | P3C.695752 | Assembly pin, long, HP compressor disk/spacer bolts | 102 |
| *1038 | P3C.695719 | Retaining clip, bolts, HP compressor disk/spacer bolts | 102 |
| 476 | P3C.1086820 | Mechanical driver, HP compressor stage 7 disk | 102 |
| 477 | P3C.1086821 | Claw, mechanical driver (476) | 102 |
| 479 | P3C.1086823 | Bushed pin, mechanical driver (476) | 102 |
| 478 | P3C.1086822 | Pin, mechanical driver (476) | 102 |
| | | | |

Disassembly Tools Table 1003 (Continued)

| TOOL REF NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|--|-------------|
| *1086 | P3C.695775 | Multiple eg sling, stage 7 disk | 1025 |
| 1419 | PJ.868932 | Container, cleaning/storage, stage 7 disk | 1025 |
| *1960 | P3C.1262679 | Multiple leg sling, HP compressor rear case | 1025 |
| 409 | P3C.1083357 | Lifting/extracting fixture, air transfer tube | 1025 |
| *1068 | P3C.695754 | Lifting fixture, LP drive shaft | 1025 |
| *1055 | P3C.695737 | Lifting fixture, LP drive shaft | 1026 |
| * 408 | P3C.1083354 | Protector, LP drive shaft rear | 1026 |
| *1092 | P3C.699312 | Transporter, LP drive shaft | 1026 |
| *1332 | PJ.893292 | Mobile stand, LP drive shaft | 1026 |
| | **P3C.1246976 | • | |
| 999 | PJ.1234583 | Protector, LP drive shaft front splines/labyrinth | 1026 |
| *1060 | P3C.695745 | Beam type sling, HP drive shaft | 1026 |
| * 405 | PJ.1083351 | Turnover stand, HP drive shaft | 1027 |
| | **P3C.1246890 | · | |
| * 385 | P3C.1083268 | Bolt, slave, HP drive shaft/ sling (1060) | 1027 |
| * 391 | P3C.1083275 | Spacer sleeve, LP drive shaft | 1014 |
| 1234 | P3C.862335 | Mechanical puller, HP drive shaft bearing inner race | 1027 |
| *1069 | P3C.695755 | Lifting fixture, HP drive shaft | 1027 |
| * 1453 | PJ.868979 | <pre>Fixture, cleaning/storage, HP drive shaft</pre> | 1027 |
| *1238 | P3C.862479 | Protector, HP drive shaft thread | 1028 |
| *1241 | P3C.863304 | Protector, HP drive shaft labyrinth | 1028 |
| *1051 | P3C.695730 | Beam type sling, adapter (1041) | 1014 |
| * 403 | P3C.1083349 | Protector, LP drive support sleeve (1031) | 1015 |

Disassembly Tools Table 1003 (Concluded)



5. HP Compressor Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FI NO |
|-----------------|-----------------------|---|----------|
| *1453 | PJ.868979 | | |
| | | Fixture, cleaning/storage, HP drive shaft | 10 |
| *1238 | P3C.862479 | Protector, HP drive shaft thread | 10 |
| * 1069 | P3C.695755 | Lifting fixture, HP drive shaft | 10 |
| *1086 | PJ.695775 | Multiple leg sling, stage 7 rotor disk | 10 |
| *1239 | PJ.862841 | Protector, HP drive shaft labyrinth | 10 |
| *1060 | PJ.695745 | Beam type sling, HP drive shaft | 10 |
| * 405 | PJ.1083351 | Turnover stand, HP drive shaft | 10 |
| | *P3C.1246890 | • | _ |
| 928 | PJ.1229257 | Locating pin, HP drive shaft/ stage 7 disk | 10 |
| * 385 | P3C.1083268 | Bolt, slave, HP drive shaft/ sling (1060) | 10 |
| 378 | P3C.1083267 | Support plate, locating pin (928) | 10 |
| *1238 | P3C.862479 | Protector, HP drive shaft thread | 10 |
| 248 | P3C.1072888 | Bearing, slave, rear bearing adapter (1028) | 10 |
| 1070 | P3C.695756 | Mechanical driver, HP drive shaft inner bearing | 10 |
| 1028 | P3C.695702 | Rear bearing adapter, HP compressor | 10 |
| *1054 | P3C.695736 | Multiple leg sling, rear bearing adapter (1028) | 10 |
| *1027 | P3C.695701 | Pit stand, HP compressor | 10 |
| *1241 | P3C.863304 | Protector, HP drive shaft labyrinth | 10 |
| *1031 | P3C.695706 | Support sleeve, HP drive shaft/ compressor | 10 |
| *1029 | P3C.695703 | Mechanical jack, HP drive shaft/ compressor | 10 |
| *1030 | P3C.695705 | Support sleeve, LP drive shaft | 10 |
| * 408 | P3C.1083354 | Protector, LP drive shaft rear | 10 |
| 407 | P3C.1083353 | Protector, LP drive shaft front | 10 |

Assembly Tools Table 1004 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 406 | PJ.1083352 | Protector, LP drive shaft front | 1029 |
| * 377 | P3C.1083264 | Guide sleeve, LP drive shaft | 1002 |
| *1068 | P3C.695754 | Lifting fixture, LP drive shaft | 1025 |
| *1332 | PJ.893292 | Mobile stand, LP drive shaft | 1026 |
| | **P3C.1246976 | | |
| *1092 | P3C.699312 | Transporter, LP drive shaft | 1026 |
| 1071 | P3C.695759 | Lifting/assembly fixture, air transfer tube | 1029 |
| 1072 | P3C.695760 | Guide, air transfer tube | 1029 |
| * 287 | P3C.1073110 | Steady, LP drive shaft front | 1019 |
| *1960 | P3C.1262679 | Multiple leg sling, HP compressor rear case | 1025 |
| *1359 | PJ.898012 | Protector, wooden exit guide/ stator vanes/blades | 1022 |
| *1441 | POJ.868965 | Container, cleaning/storage, HP spacers | 1017 |
| 978 | PJ.1244722 | Assembly pin, stage 6-7 spacer ring bolt | 1030 |
| *1038 | P3C.695719 | Retaining clip, bolts, HP compressor disk/spacer stages 4-7 | 1024 |
| 608 | P3C.1089099 | Support block, assembly of 6-7 spacer ring to stage 7 disk | 1030 |
| 604 | P3C.1089095 | Locating pin (608) | 1030 |
| *1086 | P3C.695775 | Multiple leg sling, stage 7 disk | 1025 |
| 1922 | PJ.1244721 | Heat shield (757) | 1030 |
| 757 | P3C.1089384 | Heater, HP compressor disks and spacer | 1030 |
| 759 | P3C.1089386 | Mobile stand, heater (757) and control (758) | 1031 |
| *1645 | T.251081 | Multiple leg sling, heater (757) | 1018 |
| 758 | P3C.1089385 | Control, heater (757) | 1031 |
| 1088 | P3C.695797 | Multiple leg sling, spacer rings | 1031 |
| 1923 | PJ.1244723 | Scissor retaining clips, stage 6-7 spacer bolts | 1031 |
| 1924 | PJ.1255598 | Index plate, stage 6-7 spacer ring | 1031 |

Assembly Tools Table 1004 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------------|--|------|
| 1925 | PJ.1255597 | Restrainer, HP compressor rotor | 1032 |
| * 1517 | P3C.1244664 | Cranked ring wrench, HP compressor disk/spacer bolts | 1023 |
| 57 | P3C.1234511 | Checking gauge, HP compressor rotor | 1032 |
| 289 | P3C.1073112 | Pin gauge, probe vane position setting | 1032 |
| * 1065 | P3C.695750 | Assembly pin, short, HP compressor disk/spacer bolts | 1024 |
| *1166 | P3C.1259776 **P3C.857325 | Retainer strap, compressor blades | 1020 |
| * 404 | P3C.1083350 | Multiple leg sling, HP compressor disk | 1016 |
| 1955 | PJ.1299757 | Alignment rod, assembly pins | 1032 |
| *1038 | P3C.695719 | Retaining clip, disk and spacer bolts | 1024 |
| 1064 | P3C.695749 | Mechanical driver, HP compressor disk/spacer bolts | 1024 |
| 1066 | P3C.695751 | Locating key, mechanical driver (1064)/assembly pin (1065) | 1033 |
| 1079 | PJ.695753 | Locating key, mechanical driver (1064)/assembly pin (1067) | 1033 |
| * 1067 | P3C.695752 | Assembly pin, long, HP compressor disk/spacer sleeve | 1024 |
| 1956 | P3C.1262699 | Cranked ring wrench, spacer bolts | 1033 |
| 1952 | P3C.1262660 | Angled alignment key, spacer bolts | 1033 |
| 1950 | PJ.1294424 | Packing piece, stage 3-6 compressor disks | 1033 |
| *1053 | PJ.695734 | Multiple leg sling, HP front case | 1022 |
| * 1360 | P3C.898011 | Protector, wooden, stator vanes/ blades | 1021 |
| *1361 | P30.898010 | Protector, wooden, stator vanes/ blades | 1020 |
| 1362 | P3C.898009 | Protector, wooden, stator vanes/ blades | 1034 |

Assembly Tools
Table 1004 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|------------------------------|---|------|
| 1989 | P3C.1259765 | Retaining clip, bolts, HP compressor disk/spacer stages 1-3 | 1034 |
| 1363 | P3C.898008 | Protector, wooden, stator vanes/ blades | 1034 |
| *1420 | POJ.868934 | Container, cleaning/storage, HP rotor shaft front | 1018 |
| * 392 | P3C.1083278 | Protector, HP rotor shaft front labyrinth | 1017 |
| * 388 | P3C.1083272 | Lifting fixture, HP rotor shaft front | 1018 |
| 1954 | PJ.1294423 | Packing piece, stage 1-2 compressor disks | 1034 |
| * 288 | P3C.1073111 | Steady, HP rotor shaft front | 100 |
| *1364 | PJ.898007 | Protector, wooden, stator vanes/ blades | 101 |
| *1289 | P3C.867499 | Bearing, slave, front bearing adapter (1032) | 100 |
| *1032 | PJ.695708 | Front bearing adapter, HP compressor | 100 |
| *1353 | PJ.899007 | Lifting/extracting fixture, front bearing adapter (1032) | 100 |
| * 870 | P3C.1263663 | Spacer ring, HP rotor shaft front | 100 |
| * 891 | P3C.1262603 | Adapter, mechanical driver (900) | 100 |
| * 521 | P5J.1264682 **P3C.1234501 | Extension, part of driver (900) | 100 |
| * 9 00 | P3C.1223020 | Mechanical driver, hydraulic, slave bearing assembly | 100 |
| * 988 | P3C.1234509 | Spacer ring, HP rotor shaft front | 100 |
| *1324 | PJ.892959 | Spanner wrench, front bearing | 100 |
| | **P3C.1089500 | retaining nut | |
| *1158 | P3C.850969 | Steady, front bearing adapter (1032) | 100 |
| * 387 | P3C.1083270 | Immobiliser, HP rotor shaft front | 100 |
| *1022 | P3C.684642 | Multiplier, spanner wrench (386) | 100 |
| * 386 | P3C.1083269 | Spanner wrench, HP compressor bearing | 100 |

Assembly Tools
Table 1004 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---|-------------|
| *1339 | P3C.896939 | Immobiliser, HP rotor shaft front | 1006 |
| * 290 | P3C.1073114 | Steady, LP drive shaft front | 1006 |
| * 292 | P3C.1073116 | Support, LP drive shaft front | 1006 |
| *1340 | P3C.896940 | Knurled nuts, immobiliser (1339) | 1006 |
| * 291 | P3C.1073115 | Locking nut, steady (290) | 1007 |
| * 395 | P3C.1083281 | Protector, HP compressor case blow-off aperture | 1007 |
| * 394 | P3C.1083280 | Protector, HP compressor case vent aperture | 1007 |
| *1058 | P3C.695743 | Split sleeve, LP drive shaft | 1001 |
| *1055 | P3C.695737 | Lifting fixture, LP drive shaft/ HP compressor | 1026 |
| *1036 | P3C.695712 | Mobile stand, HP compressor | 1001 |
| | **P3C.896948 | , | |
| 977 | P30.1255589 | Retaining clip assy, HP drive shaft labyrinth bolts | 1035 |
| 1149 | P3C.1246971 | Retaining clip assy, HP drive shaft labyrinth bolts | 1035 |
| 755 | P3C.1089372 | Container, freezing agent, HP compressor labyrinth | 1035 |
| 1321 | P30.893232 | Assembly sleeve, labyrinth bolt retaining rings | 1035 |
| 1999 | PJ.1299779 | Retaining clip, labyrinth retaining bolts | 1035 |
| *1543 | P3C.1244614 | Cranked ring wrench, labyrinth nuts | 1014 |
| *3141 | \$3\$14842000 | Cranked ring wrench, labyrinth | 1013 |
| * 414 | P3C.1083358 | Spacer ring, HP drive shaft | 1013 |
| 418 | P3C.1234554 | Slave nut, HP drive shaft | 1035 |
| * 410 | P30.1083360 | Spanner wrench, rear bearing retaining nut | 1013 |

Assembly Tools Table 1004 (Concluded)



6. HP Compressor Concentricity, Swash and Balance Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|-------|
| *1073 | P3C.695763 | Support, HP compressor | 1011 |
| *1074 | P3C.695764 | Spacer, support (1073), HP compressor | 1009 |
| *1075 | P3C.695765 | Spacer, support (1073), HP compressor | 1009 |
| *1059 | P3C.695744 | Jack, LP drive shaft support | 1011 |
| *1055 | P3C.695737 | Lifting fixture, LP drive shaft/ HP compressor | 1026 |
| *1027 | P3C.695701 | Pit stand, HP compressor | 1001 |
| *1056 | P3C.695739 | Beam type sling, HP compressor | 1010 |
| *1394 | PJ.899274 | Single leg sling, sling (1056), HP compressor | 1010 |
| *1076 | P3C.695766 | Front support, HP compressor | 1010 |
| * 292 | P3C.1073116 | Support, LP drive shaft front | 1006 |
| *1306 | P3C.871923 | Rear support, HP compressor | 1011 |
| *1058 | P3C.695743 | Split sleeves, LP drive shaft | 1001 |
| * 1 | P3C.1050066 | Checking gauge, HP compressor concentricity check, stage 3 | .1011 |
| * 90 | P3C.1050050 | Container, checking gauge (1 and 2) | 1012 |
| * 2 | P3C.1050067 | Checking gauge, HP compressor concentricity check, stage 4 | 1012 |
| *1090 | P3C. 695799 | Adjustable support, LP drive shaft | 1010 |
| *1036 | P3C.695712 | Mobile stand, HP compressor | 1001 |
| *1988 | PJ.1264661/2 | Guard, protection, belt | 1036 |
| * 414 | P3C.1083358 | Spacer ring, HP drive shaft | 1013 |

Concentricity, Swash and Balancing Tools Table 1005 (Concluded)

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7. HP Turbine Assembly, Balance and Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| * 292 | P3C.1073116 | Support, LP drive shaft | 1006 |
| *1339 | P3C.896939 | Immobiliser, HP rotor shaft front | 1006 |
| *1341 | P3C.896941 | <pre>Knurled headed bolts, immobiliser (1339)</pre> | 1007 |
| *1058 | P3C.695743 | Split sleeves, LP drive shaft | 1001 |
| * 410 | P3C.1083360 | Spanner wrench, rear bearing retaining nut | 1013 |
| * 414 | P3C.1083358 | Spacer ring, HP drive shaft | 1013 |
| *1315 | P3C.892955 | Adapter, immobiliser (1343) | 1007 |
| *1343 | P3C.896945 | Immobiliser, HP hub/drive shaft | 1007 |
| *1022 | P3C.684642 | Multiplier, spanner wrench (1085) | 1003 |
| *1085 | P3C.695770 | Spanner wrench, HP hub nut | 1008 |
| *1342 | P3C.896944 | Torque loading arm, HP hub nut | 1008 |
| *1344 | P3C.896946 | Weight carrier, torque loading arm (1342) | 1008 |
| *1345 | P3C.896947 | Weight, torque loading arm (1342) | 1008 |
| *1120 | P3C.699964 | Lifting fixture, HP turbine wheel | 1008 |
| * 393 | P3C.1083279 | Split sleeve, LP drive shaft/HP rear labyrinth | 1008 |
| *1062 | P3C.695747 | Protector, HP turbine hub labyrinth | 1009 |
| *1061 | P3C.695746 | Protector, HP turbine rear labyrinth | 1009 |
| *1063 | P3C.695748 | Protector, HP turbine front labyrinth | 1009 |
| *1126 | P3C.699970 | Protection band, HP turbine blades | 1009 |
| *1075 | P3C.695765 | Spacer, support (1073), HP compressor | 1009 |
| *1074 | P3C.695764 | Spacer, support (1073), HP compressor | 1009 |
| *1090 | P3C.695799 | Adjustable support, LP drive shaft | 1010 |
| *1291 | PJ.867097 | Bracket, guard (1303) | 1010 |
| *1303 | P3C.869283 | Guard, protection, HP turbine wheel | 1010 |
| *1056 | P3C.695739 | Beam type sling, HP compressor | 1010 |

Assembly, Balance and Disassembly Tools Table 1006 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| *1394 | P3C.899274 | Single leg sling, sling (1056), HP compressor | 1010 |
| *1076 | P3C.695766 | Front support, HP compressor/ turbine assembly | 1010 |
| *1306 | P3C.871923 | Rear support, HP compressor/ turbine assembly | 1011 |
| *1055 | P3C.695737 | Lifting fixture, LP drive shaft | 1026 |
| *1036 | P3C.695712 | Mobile stand, HP compressor | 1001 |
| *1988 | PJ.1264661/2 | Guard, protection, belt | 1036 |
| *1292 | PJ.867803 | Tie bar, balancing machine | 1011 |
| *1293 | PJ.867804 | Tie bar, balancing machine | 1011 |
| *1027 | P3C.695701 | Pit stand, HP compressor | 1001 |
| *1073 | P3C.695763 | Support, HP compressor | 1011 |
| *1247 | PJ.863652 | Mechanical puller, HP turbine | 1012 |
| | **P3C.1263649 | rear labyrinth | |
| *1111 | P3C.699961 | Mobile stand, HP turbine wheel | 1012 |
| * 139 | P3C.699962 | Mandrel, HP turbine wheel | 1012 |
| *1113 | P3C.699963 | Lifting fixture, mandrel (139) | 1012 |
| *1057 | P3C.695740 | Extractor/lifting fixture, HP turbine hub | 1013 |

Assembly, Balance and Disassembly Tools Table 1006 (Concluded)

8. HP Turbine Simulator Assembly, Assembly and Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-------------------------------|---|------|
| 1993 | PJ.1294514) S3S.15623000) | Lifting/Assembly/Extractor HP turbine simulator | 1036 |
| 1994 | PJ.1294512) S3S.15260000) | HP turbine simulator | 1036 |

Assembly and Disassembly Tools Table 1007 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-------------------------------|---|------|
| 418 | P3C.1234554 | Slave nut, HP drive shaft | 1035 |
| * 334 | P3C.1076074 | Lifting ring, spanner (1085) | 1007 |
| 1995 | PJ.1294521) S3S.15626000) | Torque restrainer HP drive shaft slave nut | 1037 |
| 1996 | PJ.1297562 | Lifting ring, multiplier 1022 | 1037 |
| | PJ.1294520) S3S.15625000) | Adapter plate, torque restrainer 1995 | 1037 |
| 1998 | PJ.1297587 | Centralizing sleeve, LP drive shaft | 1037 |
| 3051 | • | HP turbine simulator storage container | 1036 |
| NOTE: | | ed in this Table but quoted in the er para.9 and 10 may be found in | |

Assembly and Disassembly Tools Table 1007

9. Intermediate Case Assembly to HP Compressor Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| *1058 | P3C.695743 | Split sleeves, LP drive shaft | 1001 |
| * 37 7 | P3C.1083264 | Guide sleeve, LP drive shaft | 1002 |
| *1031 | P3C.695706 | Support sleeve, HP drive shaft/ compressor | 1002 |
| *1029 | P3C.695703 | Mechanical jack, HP drive shaft/ compressor | 1002 |
| *1030 | P3C.695705 | Support sleeve, LP drive shaft | 1002 |
| 1226 | P3C.860762 | Restraining screw, LP drive shaft | 1038 |
| * 292 | P3C.1073116 | Support, LP drive shaft | 1006 |
| * 290 | P3C.1073114 | Steady, LP drive shaft | 1006 |

Intermediate Case Assembly Tools Table 1008 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| *1339 | P3C.896939 | Immobiliser, HP rotor shaft front | 1006 |
| *1340 | P3C.896940 | Knurled nuts, immobiliser (1339) | 1006 |
| * 291 | P3C.1073115 | Locking nut, steady (290) | 100 |
| *1158 | P3C.850969 | Steady, front bearing adapter (1032) | 100 |
| * 387 | P3C.1083270 | Immobiliser, HP rotor shaft front | 100 |
| *1022 | P3C.684642 | Multiplier, spanner wrench (386) | 100 |
| * 386 | P3C.1083269 | Spanner wrench, HP compressor bearing | 100 |
| * 988 | P3C.1234509 | Spacer ring, HP rotor shaft front | 100 |
| * 288 | P3C.1073111 | Steady, HP rotor shaft front | 100 |
| *1353 | P3C.899007 | Lifting/extractor fixture, front bearing adapter (1032) | 100 |
| * 870 | P3C.1262663 | Spacer ring, HP rotor shaft front | 100 |
| *1246 | P3C.863651 | Protector, HP compressor, front end | 100 |
| 1352 | P3C.899006 | Immobiliser, LP drive shaft | 103 |
| 1089 | P3C.695798 | Multiple leg sling, intermediate case | 103 |
| *1232 | PJ.862326 | Transport blocks, intermediate case | 1004 |
| 520 | P3C.1263645 | Sleeve, bevel gear | 1038 |
| 1351 | P3C.899005 | Mechanical puller, HP compressor bearing | 103 |
| * 891 | P3C.1262603 | Adapter, mechanical driver (900) | 1009 |
| * 521 | P5J.1264682 | Extension, part of driver (900) | 100 |
| | **P3C.1234501 | · · | |
| * 900 | PJ.1223020 | Mechanical driver, hydraulic, bearing assembly | 100 |
| * 397 | P5J.1083283 | Steady, spanner wrench (1324) | 1003 |
| *1324 | PJ.892959 | Spanner wrench, front bearing | 1004 |
| | **P3C.1089500 | retaining nut | |
| * 396 | PJ.1083282 | Support steady, LP drive shaft | 100 |
| 50 | PG.1223144 | Checking gauge, HP rotor position | 1039 |
| 990 | PJ.1259769 | Peening fixture, HP rotor shaft front | 1039 |

Intermediate Case Assembly Tools
Table 1008 (Continued)

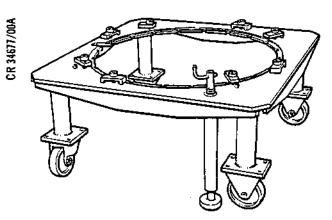
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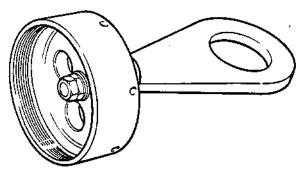
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| 991 | PJ.1259770 | Pin, peening fixture (990) | 1039 |
| 1009 | PJ.1259771 | Pin, peening fixture (990) | 1039 |
| 1010 | PJ.1259772 | Pin, peening fixture (990) | 1039 |
| * 411 | P3C.1083361 | Lifting/extracting fixture, intermediate case | 1004 |
| 389 | P3C.1083273 | Spacer sleeve, LP drive shaft | 1039 |
| *1042 | P3C.695726 | Nut, slave, LP drive shaft | 1001 |
| *1043 | P3C.695727 | Lifting fixture, HP compressor | 1001 |
| *1036 | P3C.695712 | Mobile stand, HP compressor/ intermediate case | 1001 |
| 210 | PJ.1065974 | Protector, rear bearing adapter and LP shaft | 1039 |

Intermediate Case Assembly Tools Table 1008 (Concluded)

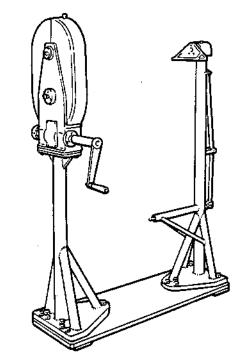




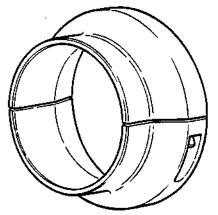
TOOL 1036 42.00 X 42.00 X 23.50 IN (1070 X 1070 X 600 MM)



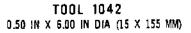
TOOL 1043 15.25 X 7.25 IN DIA (390 X 185 MM)



TOOL 1027 76.00 X 58.00 X 29.50 (1930 X 1475 X 750 MM)



TOOL 1058 3.00 X 6.25 IN DIA (80 X 160 MM)



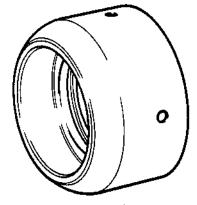
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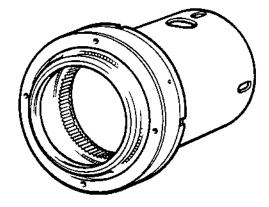
MMPUS 508 mk.610-14-28 overhaul



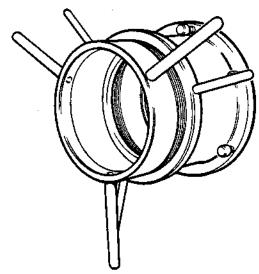
CR 34678/00A



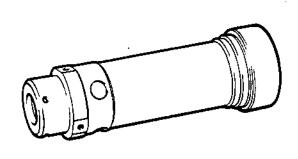
TOOL 377 2.75 X 4.50 IN DIA (70 X 115 MM)



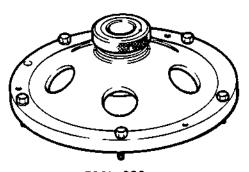
TOOL 1031 14.50 X 10.75 IN DIA (370 X 275 MM)



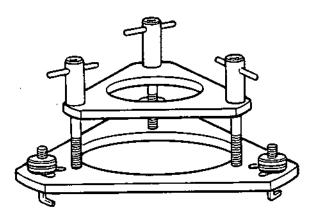
TOOL 1029 30.50 X 26.50 X 8.75 IN (775 X 675 X 225 MM)



TOOL 1030 22.25 X 7.25 IN DIA (570 X 185 MM)



TOOL 396 5.00 X 12.50 IN DIA (130 X 320 MM)

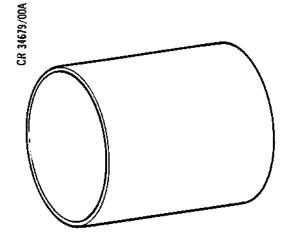


TOOL 1962 9.25 X 8.25 X 4.50 IN (235 X 210 X 115 MM)

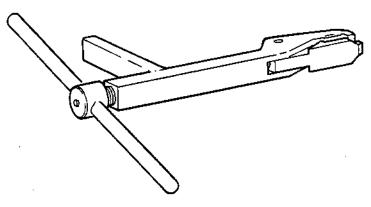
HP Compressor Assembly - Special Tools Figure 1002

SPECIAL TOOLS ETC

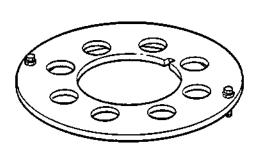
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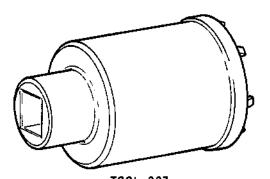
TOOL 427 5.75 X 4.75 IN DIA (150 X 125 MM)



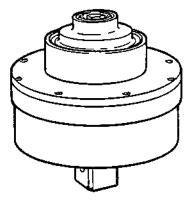
TOOL 1523 9.75 X 9.00 X 1.75 IN (250 X 230 X 45 MM)



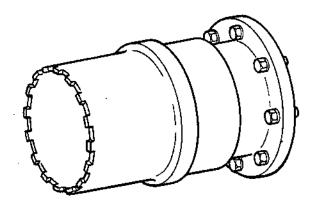
TOOL 397 1.75 X 12.50 IN OIA (45 X 320 MM)



TOOL 387 8.50 X 5.25 IN DIA (220 X 135 MM)



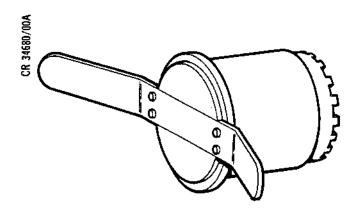
TOOL 1022 7.50 X 7.25 IN DIA (195 X 185 MM)



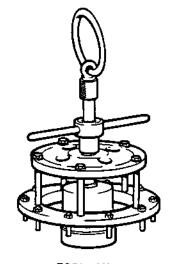
TOOL 386 9.50 X 7.00 IN DIA (245 X 180 MM)

SPECIAL TOOLS ETC

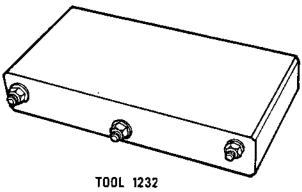
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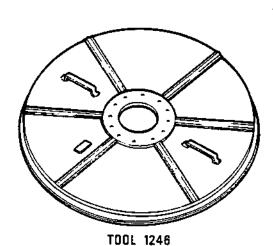
TOOL 1324 22.00 X 9.75 X 7.50 IN DIA (560 X 250 X 195 MM)



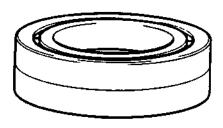
TOOL 411 23.00 X 13.25 IN (590 X 340 MM)



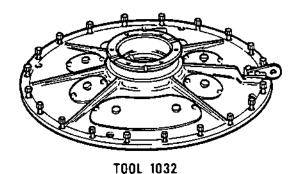
8.25 X 4.75 X 1.50 IN (210 X 125 X 40 MM)



2.75 X 35.00 IN DIA (70 X 890 MM)



TOOL 1289 2.50 X 8.50 IN DIA (65 X 220 MM)

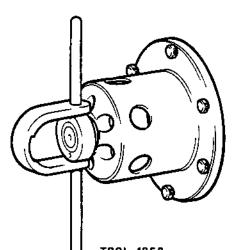


36.50 X 6.50 X 35.75 IN DIA (930 X 170 X 910 MM)

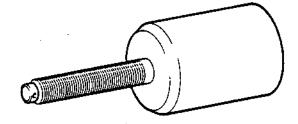
SPECIAL TOOLS ETC

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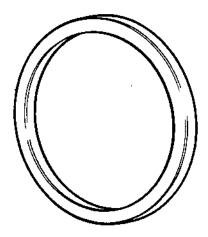




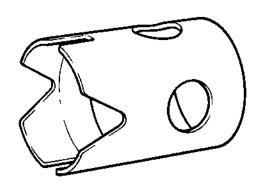
U TOOL 1353 20.00 X 10.25 X 9.75 IN (510 X 265 X 250 MM)



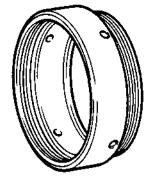
TOOL 288 16.25 X 5.50 IN DIA (415 X 140 MM)



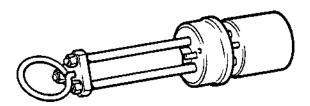
TOOL 870 0.50 X 6.25 IN DIA (15 X 160 MM)



TOOL 891 8.50 X 6.00 IN DIA (220 X 155 MM)



TOOL 521 2.25 X 5.50 IN DIA (60 X 140 MM)



TOOL 900 29.25 X 6.50 IN DIA (750 X 165 MM)

SPECIAL TOOLS ETC

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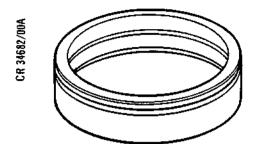
TN320/.



OLYMPUS 593

MK.610-14-28 OVERHAUL

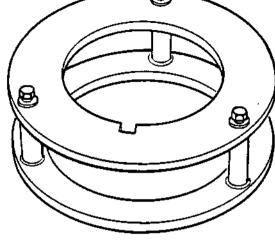




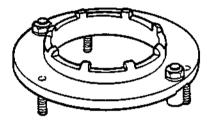
TOOL 988 1.50 X 6.00 IN DIA (40 X 155 MM)



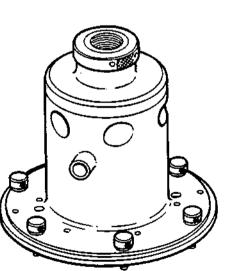
TOOL 1656 19.50 X 3.25 X 2.50 IN (500 X 85 X 65 MM)



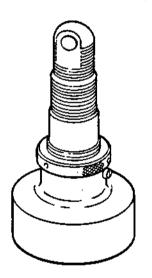
TOOL 1158 4.50 X 10.25 IN DIA (115 X 265 MM)



TOOL 1339 2,50 X 7.50 IN DIA (65 X 195 MM)



TOOL 292 10.75 X 10.75 IN DIA (275 X 275 MM)



TOOL 290 9.00 X 4.75 IN DIA (230 X 125 MM)

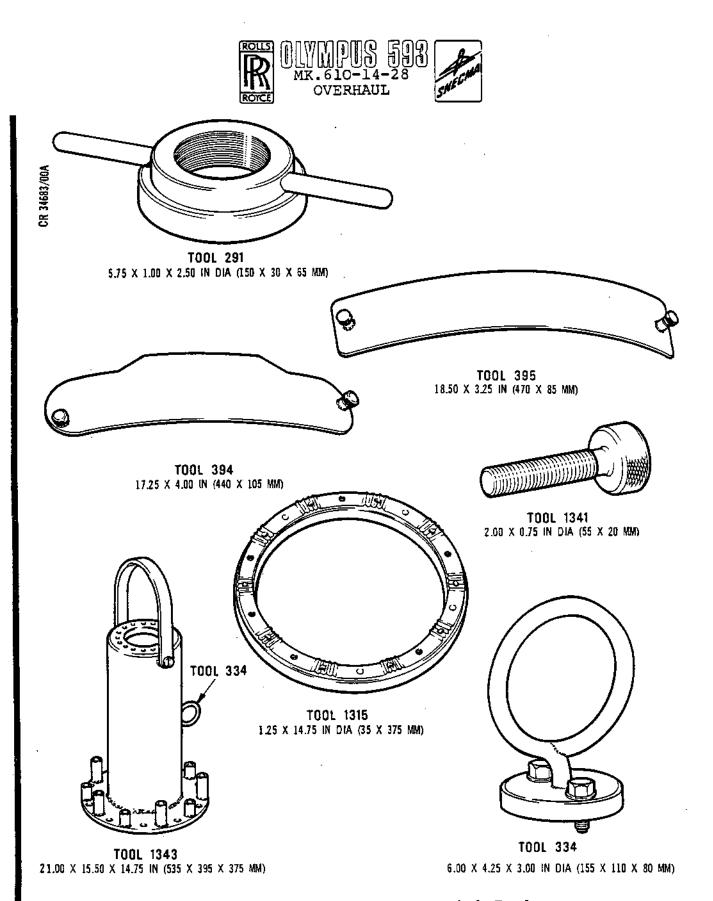


TOOL 1340 0.50 X 0.75 IN DIA (15 X 20 MM)

HP Compressor Assembly - Special Tools Figure 1006

SPECIAL TOOLS ETC

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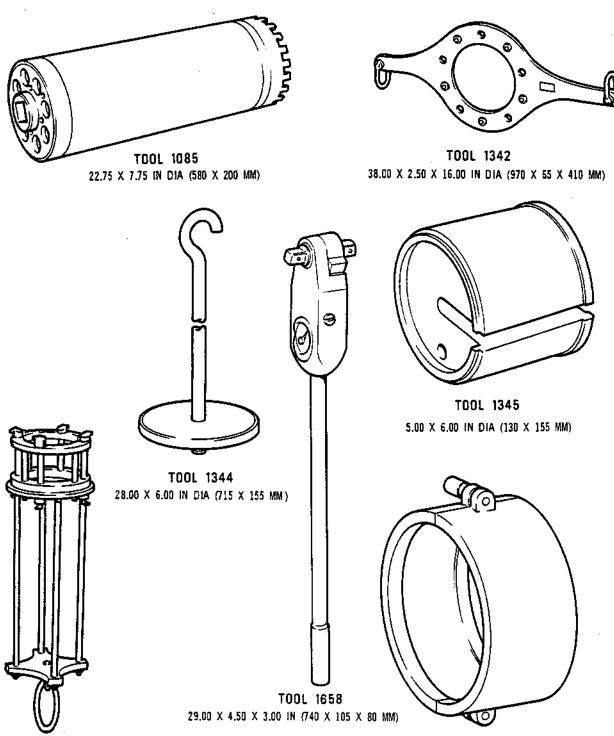


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TOOL 1120

28.25 X 7.50 IN (720 X 200 MM)





HP Compressor Assembly - Special Tools Figure 1008

SPECIAL TOOLS ETC

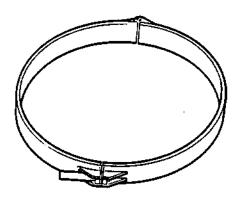
TOOL 393

7.50 X 3.00 X 6.25 IN DIA (195 X 80 X 160 MM)

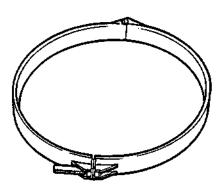
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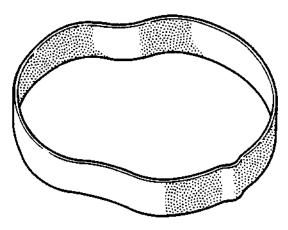
TOOL 1062 4.75 x 12.50 IN DIA (125 X 320 MM)



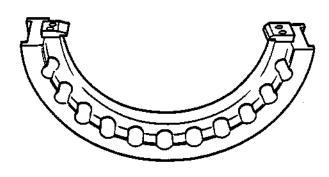
TOOL 1061 2.25 X 19.00 (N DIA (60 X 485 MM)



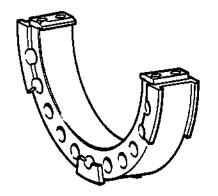
TOOL 1063 1.75 X 19.75 IN DIA (45 X 505 MM)



TOOL 1126 4.00 X 36.00 IN DIA (105 X 915 MM)



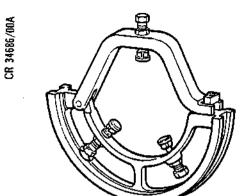
TOOL 1075 13.50 X 7.25 X 2.50 IN (345 X 185 X 65 MM)



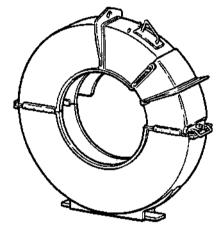
TOOL 1074 13.50 X 7.00 X 2.50 IN (345 X 180 X 55 MM)

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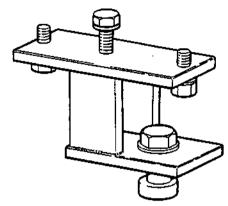
TOOL 1090 9.75 X 1.50 X 10.25 IN DIA (250 X 40 X 265 MM)



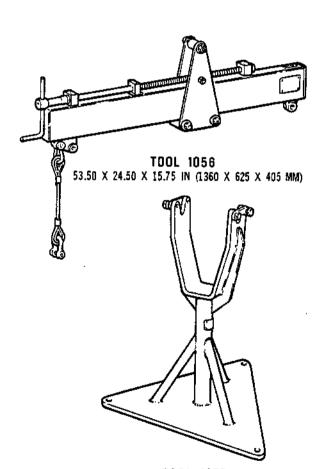
TOOL 1303 53.50 X 51.50 X 16.50 IN (1360 X 1310 X 420 MM)



TOOL 1394 20.50 X 0.50 IN (525 X 15 MM)



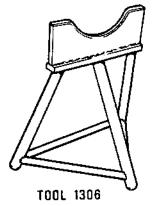
TOOL 1291 7.50 X 6.75 X 3.00 IN (195 X 175 X 80 MM)



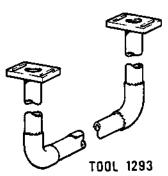
TOOL 1076 30.50 X 22.50 X 19.75 IN (775 X 575 X 505 MM)

SPECIAL TOOLS ETC

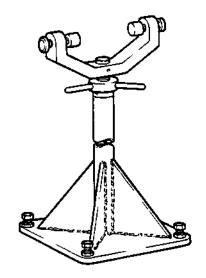
72-33-00 Page 1031



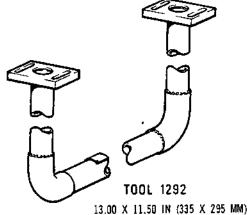
26.00 X 26.00 X 16.75 IN (665 X 665 X 430 MM)

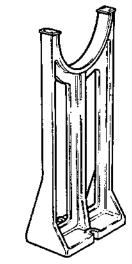


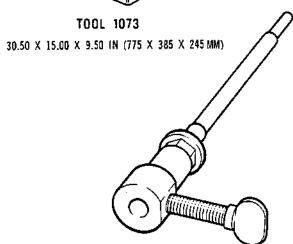
23.00 X 11.50 IN (585 X 295 MM)



TOOL 1059 30.75 X 10.50 X 10.00 IN (785 X 270 X 255 MM)







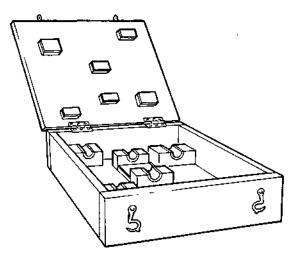
TOOL 1 5.50 X 2.25 X 0.75 IN (140 X 60 X 20 MM)

SPECIAL TOOLS ETC

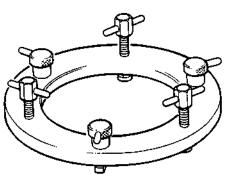
72-33-00 Page 1032 Aug 1/78

CR 34688/00A

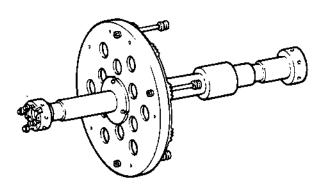




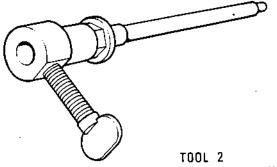
TOOL 90 7.75 x 6.50 x 2.25 IN (200 x 170 x 60 MM)



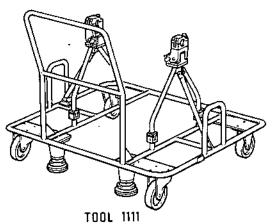
TOOL 1247 3.50 X 10.00 IN DIA (90 X 250 MM)



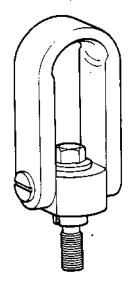
TOOL 139 31.00 X 15.50 IN DIA (790 X 395 MM)



TOOL 2 5.50 X 2.25 X 0,75 IN (140 X 60 X 20 MM)



52.50 X 45.25 X 44.00 IN (1335 X 1150 X 1120 MM)

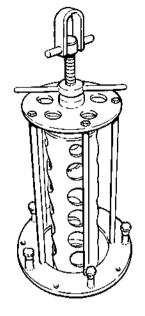


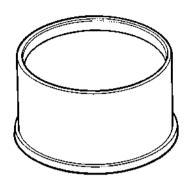
TOOL 1113 5.50 X 2.75 X 1.75 IN (140 X 70 X 45 MM)

HP Compressor Assembly - Special Tools Figure 1012

SPECIAL TOOLS ETC

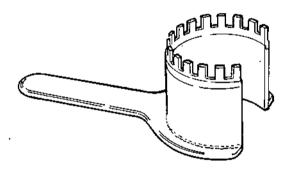
72-33-00 Page 1033 Aug 1/78 CR 34689/00B

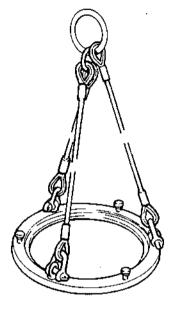




TOOL 414 $_{4.00~\times~7.50~\text{IN DIA}}$ (105 $\times~$ 195 MM)

TOOL 1057 $40.50 \times 15.25 \times 14.75$ IN DIA (1030 \times 390 \times 380 MM)

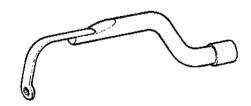




TOOL 1054 43.00 \times 13.75 IN DIA (1095 \times 350 MM)

TOOL 410 $$18.50\times7.00\times10.00$ IN DIA (470 \times 180 \times 255 MM)





TOOL 212 75.00 \times 2.00 IN DIA (1905 \times 55 MM)

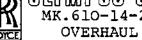
TOOL 3141 $7.40~\times~2.25~\times~0.75~\text{IN DIA (188}~\times~52~\times~15.75~\text{MM})$

HP Compressor Assembly - Special Tools Figure 1013

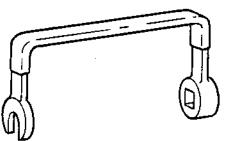
72-33-00 Page 1034 Jun 1/91



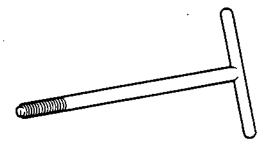




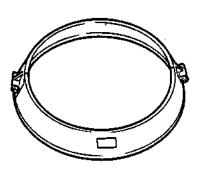




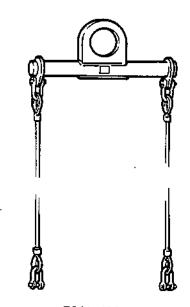
TOOL 1543 5.00 X 1.75 X 0.50 IN (130 X 45 X 15 MM)



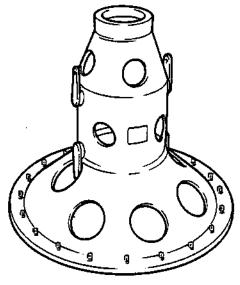
TOOL 1668 5.75 X 2.75 IN (140 X 70 MM)



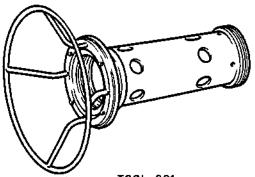
TOOL 1239 24.50 X 4.00 IN (620 X 105 MM)



TOOL 1051 37.75 X 17.75 IN (960 X 455 M)



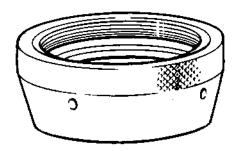
TOOL 1041 32.00 X 36.00 IN DIA (815 X 915 MM)



TOOL 391 25.00 X 20.00 IN DIA (635 X 510 MM)

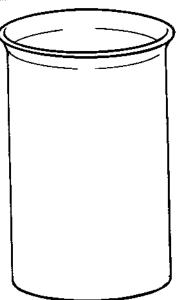
SPECIAL TOOLS ETC

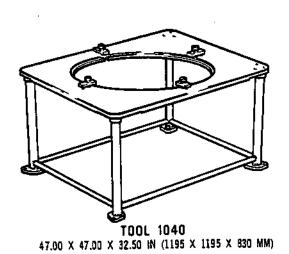
Page 1035 Aug 1/78

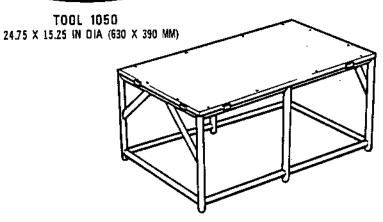


TOOL 403 3.00 x 7.25 IN DIA (80 X 185 MM)

TOOL 914 34.00 X 3.50 X 3.00 IN (865 X 90 X 80 MM)







TOOL 1233 36.25 X 24.25 X 18.00 IN (925 X 620 X 460 MM)

HP Compressor Assembly - Special Tools Figure 1015

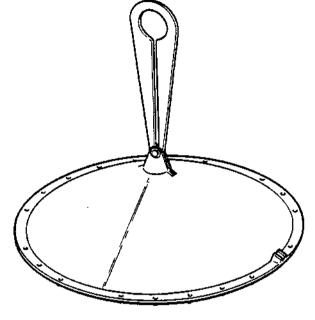
SPECIAL TOOLS ETC

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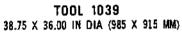


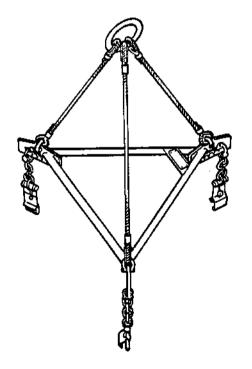




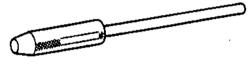


TOOL 1522 19.50 X 3.50 X 0.75 IN DIA (500 X 90 X 20 MM)

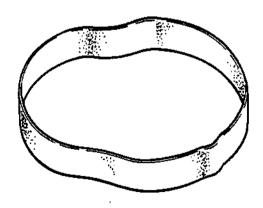




TOOL 404 46.00 X 26.50 X 22.75 IN (1170 X 675 X 580 MM)



TOOL 1225 8.00 X 0.75 (N DIA (205 X 20 MM)



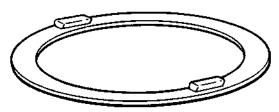
TOBL 1130 4.00 X 28.00 IN DIA (105 X 715 MM)

SPECIAL TOOLS ETC

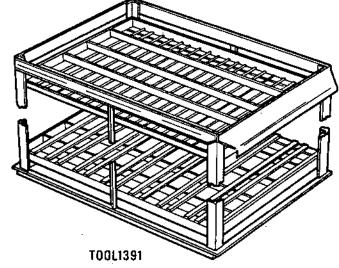
72-33-00

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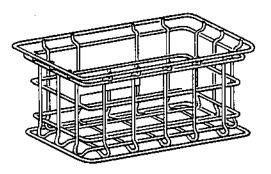




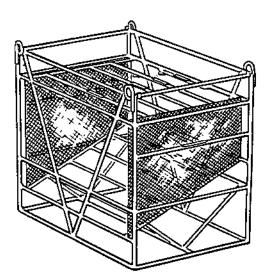
TOOL 1364 1.75 X 32.75 IN DIA (45 X 835 MM)



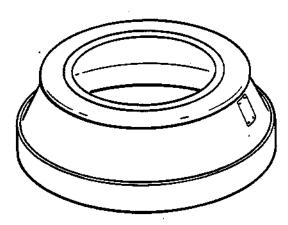
23.00 X 16.00 X 12.25 IN (585 X 410 X 315 MM)



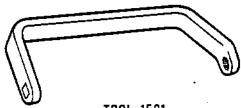
TOOL 1374 17.75 X 17.75 X 10.75 IN (455 X 455 X 275 MM)



TOOL 1441 35.50 X 31.00 X 24.25 IN (905 X 790 X 620 MM)



TOOL 392 3.50 X 10.00 IN DIA (90 X 255 MM)

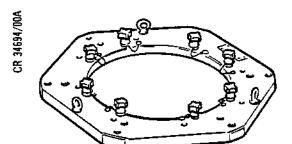


TOOL 1591 7.75 X 3.00 X 0.75 IN (200 X 80 X 20 MM)

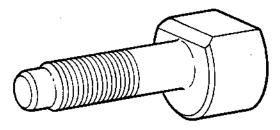
SPECIAL TOOLS ETC

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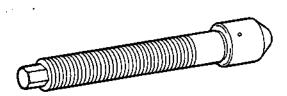




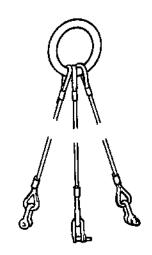
TOOL 457 19.50 X 2.25 X 22.00 IN DIA (500 X 60 X 560 MM)



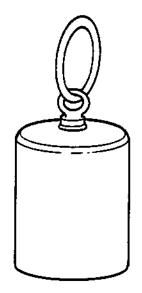
TOOL 459 2.00 X 1.00 IN DIA (55 X 30 MM)



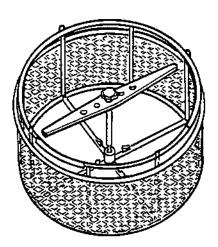
TOOL 458 5.00 X 0.75 IN DIA (130 X 20 MM)



TOOL 1645 4.00 X 36.00 IN DIA (105 X 915 MM)



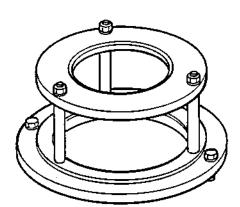
TOOL 388 13.75 X 5.50 IN DIA (350 X 140 MM)



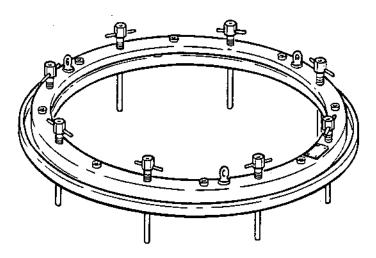
TOOL 1420 13.25 X 21.25 IN DIA (340 X 540 MM)

SPECIAL TOOLS ETC

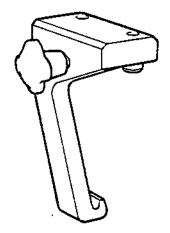
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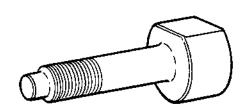
TOOL 287 4.75 X 8.75 IN DIA (125 X 225 MM)



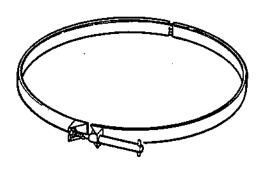
TOOL 461 8.00 X 21,25 IN DIA (205 X 540 MM)



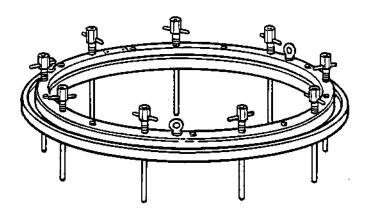
TOOL 482 4.00 X 2.50 X 2.25 IN (105 X 65 X 60 MM)



TOOL 460 2.00 X 1.00 IN DIA (55 X 30 MM)



TOOL 933 20.00 X 1.50 X 18.75 IN DIA (510 X 40 X 480 MM)



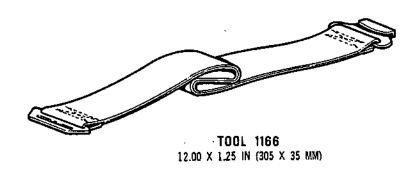
TOOL 463 7.95 X 23.25 IN DIA (200 X 595 MM)

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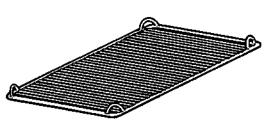
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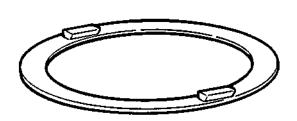
CR 34696/00A



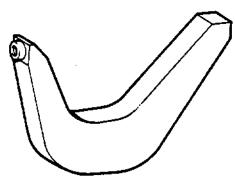
TOOL 464 4.00 X 2.50 X 2.25 IN (105 X 65 X 60 MM)



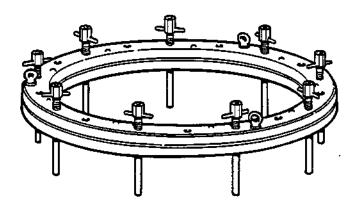
TOOL 1390 15.50 X 15.50 X 1.00 IN (395 X 395 X 30 MM)



TOOL 1361 1.75 X 32.25 IN DIA (45 X 820 MM)



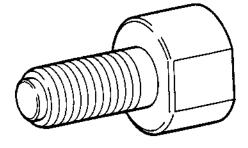
TOOL 1611 6.25 X 3.75 X 0.75 IN (160 X 100 X 20 MM)



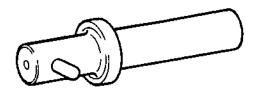
TOOL 471 6.50 X 21.00 IN DIA (170 X 535 MM)

HP Compressor Assembly - Special Tools Figure 1020

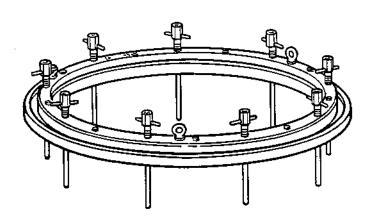
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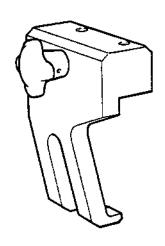
TOOL 475 1.50 X 1.00 IN DIA (40 X 30 MM)



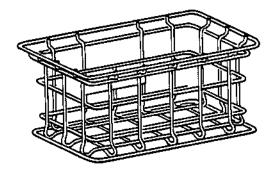
TOOL 474 4.00 X 2.00 X 1.00 IN DIA (105 X 55 X 30 MM)



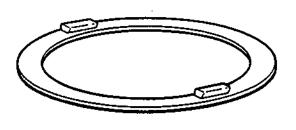
TOOL 465 7.75 X 24.50 IN DIA (200 X 625 MM)



TOOL 466 4.00 X 2.75 X 2.25 IN (105 X 70 X 60 MM)



TOOL 1373 17.50 X 17.50 X 7.75 IN (445 X 445 X 200 MM)

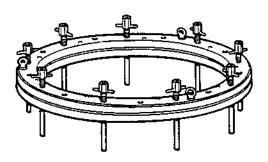


TOOL 1360 1.75 X 32.25 IN DIA (45 X 820 MM)

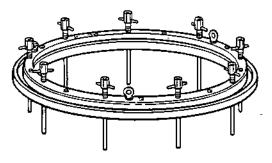
SPECIAL TOOLS ETC

TN5814

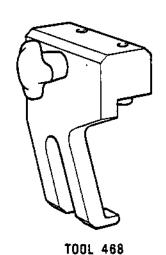
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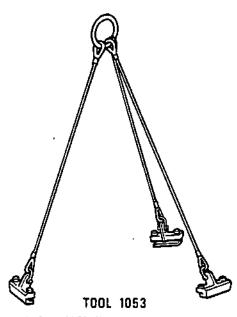
TOOL 472 6.25 X 23.00 IN DIA (160 X 585 MM)



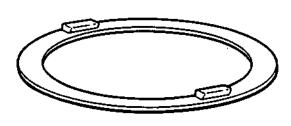
TOOL 467 7.00 X 25.75 IN DIA (180 X 655 MM)



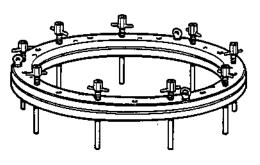
3.75 X 2.75 X 2.25 IN (100 X 70 X 60 MM)



41.50 X 34.50 IN DIA (1055 X 880 MM)



TOOL 1359 1.75 X 32.00 IN DIA (45 X 815 MM)

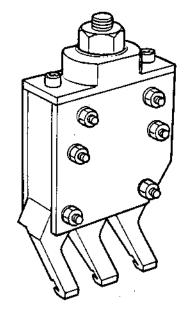


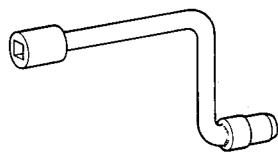
TOOL 473 6.00 X 24.00 IN DIA (155 X 610 MM)

HP Compressor Assembly - Special Tools Figure 1022

SPECIAL TOOLS ETC

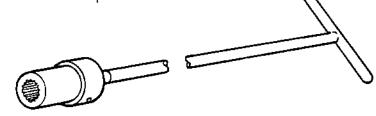
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TOOL 1517 9.75 X 5.25 X 1.00 IN DIA (250 X 135 X 30 MM)

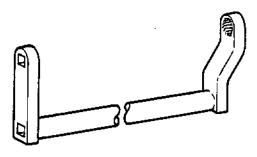
TOOL 469 5.75 X 3.50 X 2.00 IN (150 X 90 X 55 MM)



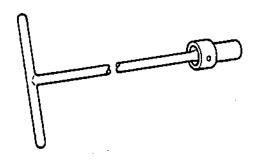


TOOL 762 13.00 X 0.50 IN OIA (335 X 15 MM)

TOOL 818 19.75 X 3.50 X 1.00 IN DIA (505 X 90 X 30 MM) -



TOOL 1544 18.75 X 3.25 X 0.75 IN (480 X 85 X 20 MM)

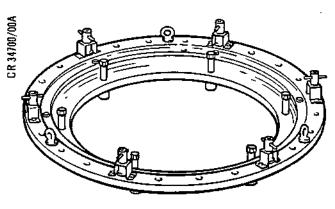


TOOL 1619 13.50 X 3.50 X 0.75 IN (345 X 90 X 20 MM)

HP Compressor Assembly - Special Tools Figure 1023

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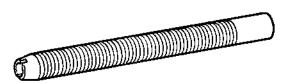




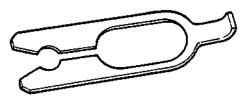
TOOL 470 5.00 X 25.75 IN DIA (130 X 655 MM)



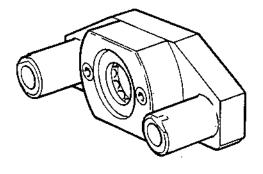
TOOL 1065 3.75 X 0.50 IN DIA (100 X 15 MM)



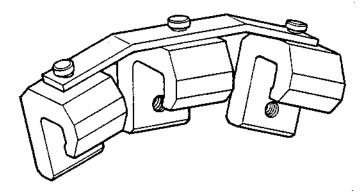
TOOL 1067 6.25 X 0.50 IN DIA (160 X 15 MM)



TOOL 1038 2.75 X 0.75 X 0.50 IN (70 X 20 X 15 MM)



TOOL 476 6.25 X 2.00 X 2.00 (160 X 55 X 55 MM)

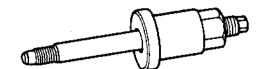


TOOL 477 7.50 X 3.25 X 2.25 IN (195 X 85 X 60 MM)

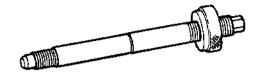
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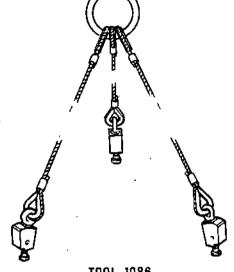




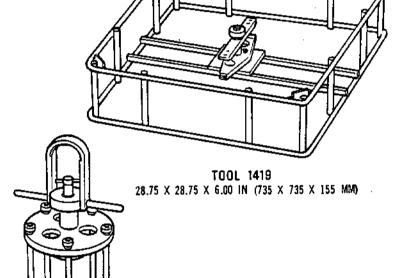
TOOL 479 6.25 X 1.50 IN DIA (160 X 40 MM)

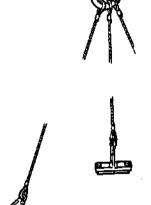


TOOL 478 6.00 X 1.25 IN DIA (155 X 35 MM)

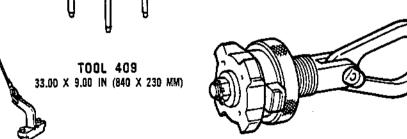


TOOL 1086 44.00 X 25.00 IN DIA (1120 X 635 MM)









TOOL 1068 9.50 X 3.50 IN DIA (245 X 90 MM)

SPECIAL TOOLS ETC

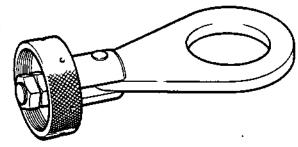
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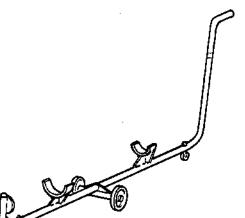
OVERHAUL



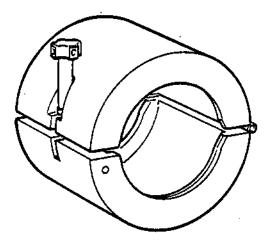
CR 34702/00A



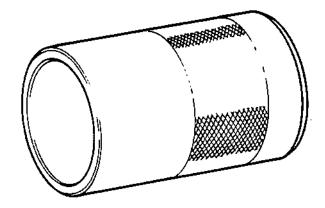
TOOL 1055 12.50 X 6.00 X 3.75 IN DIA (320 X 155 X 100 MM)



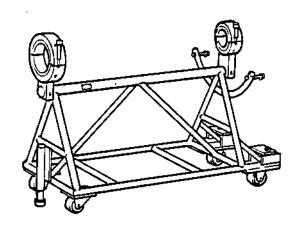
TOOL 1092 110.50 X 38.25 X 15.00 IN (2810 X 975 X 385 MM)



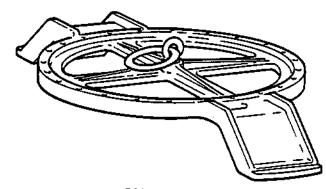
TOOL 999 6.75 X 6.25 X 5.25 IN (175 X 160 X 135 MM)



TOOL 408 8.25 X 5.25 IN DIA (210 X 135 MM)



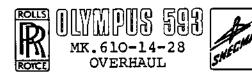
TOOL 1332 59.50 X 41.25 X 25.25 IN (1515 X 1050 X 645 MM)

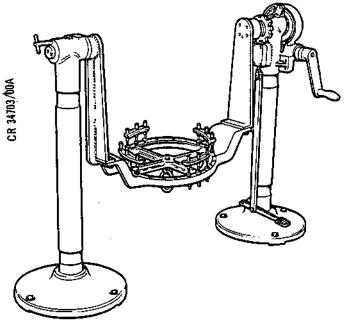


TOOL 1060 6.00 X 34.50 IN DIA (155 X 880 MM)

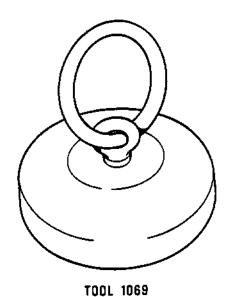
HP Compressor Assembly - Special Tools Figure 1025

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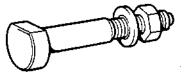




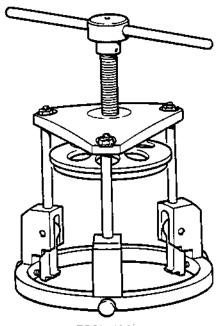
TOOL 405 62.50 X 41.75 X 21.25 IN (1590 X 1065 X 540 MM)



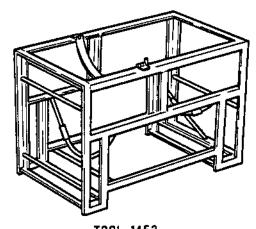
7.25 X 7.00 IN DIA (185 X 180 MM)



TOOL 385 3.00 X 1.00 IN DIA (80 X 30 MM)



TOOL 1234 13.75 X 12.00 X 11.25 IN DIA (305 X 350 X 290 MM)



TOOL 1453 38.00 X 24.00 X 24.00 (970 X 610 X 610 MM)

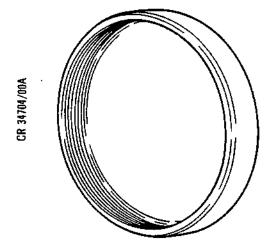
SPECIAL TOOLS ETC

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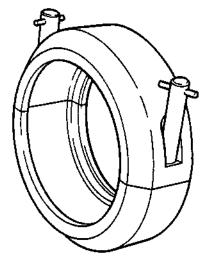


MK.610-14-28 OVERHAUL

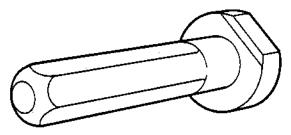




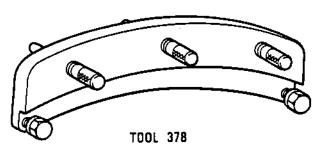
TOOL 1238 . 1.50 x 7.00 IN DIA (40 X 180 MM)



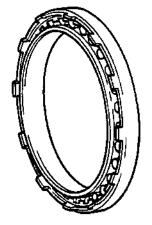
TOOL 1241 13.25 X 3.75 IN (340 X 100 MM)



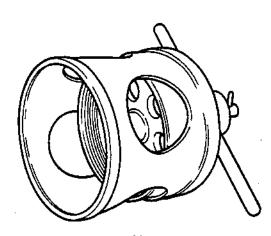
TOOL 928 3.00 X 1.00 X 1.00 IN (80 X 30 X 30 MM)



7.25 X 3.00 X 2.25 IN (185 X 80 X 60 MM)



TOOL 248 8.75 X 1.50 IN (225 X 40 MM)



TOOL 1070 15.00 X 12.00 IN (385 X 305 MM)

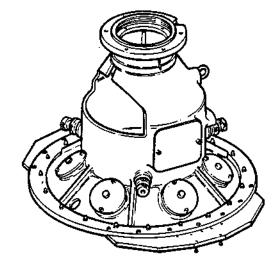
HP Compressor Assembly - Special Tools Figure 1028

SPECIAL TOOLS ETC

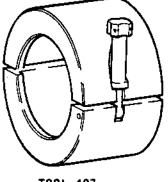
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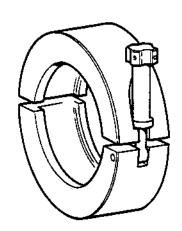




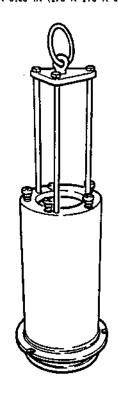
TOOL 1028 43.00 X 31.00 IN (1095 X 790 MM)



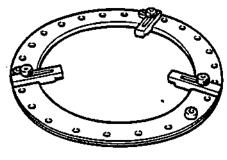
TOOL 407 6.75 X 6.50 X 3.50 IN (175 X 170 X 90 MM)



TOOL 408 6,50 X 2,00 X 6.00 IN DIA (170 X 55 X 155 MM)



TOOL 1071 42.25 X 12.00 IN DIA (1075 X 305 MM)



TOOL 1072 2.00 X 20.50 IN DIA (55 X 525 MM)

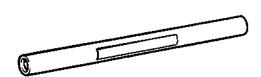
HP Compressor Assembly - Special Tools Figure 1029

SPECIAL TOOLS ETC

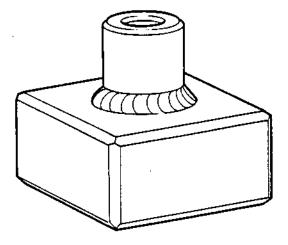
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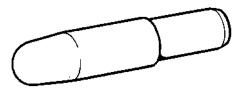




TOOL 978 4.00 X 0.25 IN (105 X 10 MM)



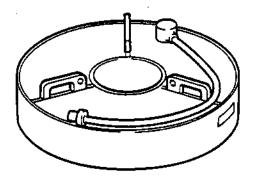
TOOL 608 3.00 X 3.00 X 2.25 IN (80 X 80 X 60 MM)



TOOL 604 2.50 X 0.50 IN DIA (65 X 15 MM)



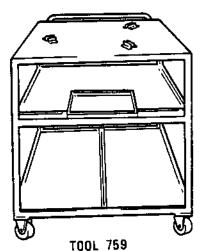
TOOL 1922 1.75 X 30.25 IN DIA (45 X 770 MM)



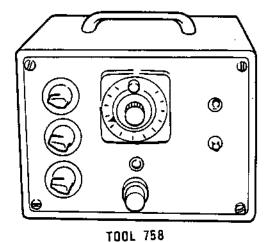
TOOL 757 6.75 X 29.75 IN DIA (175 X 760 MM)

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38.00 X 34.00 X 33.50 (970 X 865 X 855 MM)



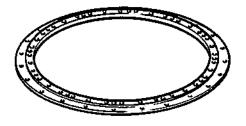
13.00 X 12.00 X 10.25 IN (335 X 305 X 265 MM)



41.25 X 24.00 IN DIA (1050 X 610 MM)



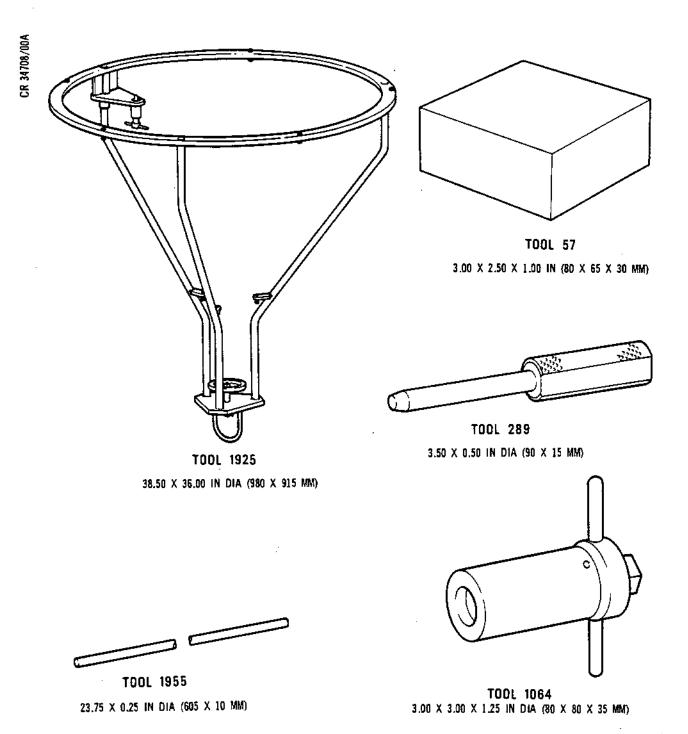
TOOL 1923 6.00 X 3.00 X 1.50 IN (155 X 80 X 40 MM)



TOOL 1924 1.00 X 27.25 IN DIA (30 X 695 MM)

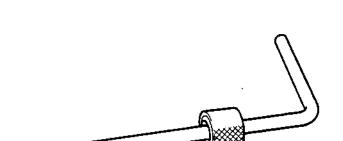
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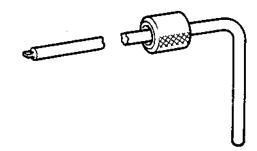


72-33-00

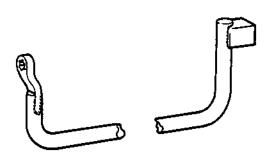
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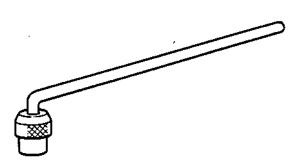
TOOL 1066 5.25 X 2.50 X 0.75 IN DIA (135 X 65 X 20 MM)



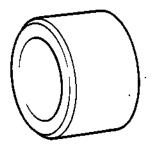
TOOL 1079 7.50 X 2.25 X 0.75 IN DIA (195 X 60 X 20 MM)



TOOL 1956 19.50 X 2.75 X 1.00 IN DIA (500 X 70 X 30 MM)



TOOL 1952 4.25 X 1.00 X 0.50 IN DIA (110 X 30 X 15 MM)

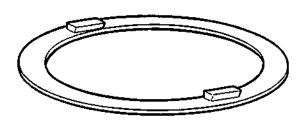


TOOL 1950 0.50 X 0.75 IN DIA (15 X 20 MM)

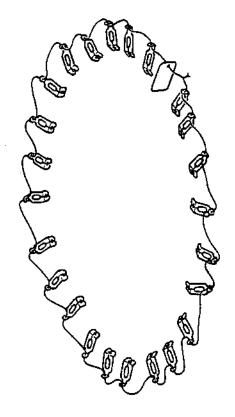
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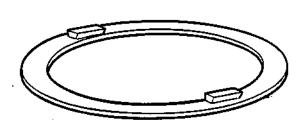
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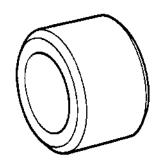
TOOL 1362 1.75 X 32.125 IN DIA (45 X 820 MM)



TOOL 1989 0.50 X 20.75 IN DIA (15 X 530 MM)



TOOL 1363 1.75 X 32.25 IN DIA (45 X 820 MM)

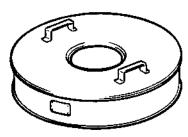


TOOL 1954 0,25 X 0.75 IN DIA (10 X 20 MM)

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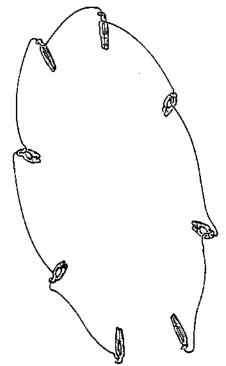
TOOL 977 0.50 X 32.00 IN DIA (15 X 815 MM)



TOOL 755 8.50 X 30.25 IN DIA (215 X 770 MM)



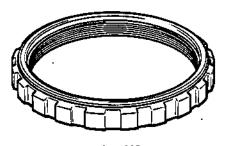
4.50 X 1.00 X 0.75 IN (450 X 30 X 20 MM)



TOOL 1149 0.50 X 35.00 IN DIA (15 X 890 MM)



TOOL 1321 1.50 x 0.50 IN DIA (40 X 15 MM)



TOOL 418 1.00 X 7.50 IN DIA (30 X 195 MM)

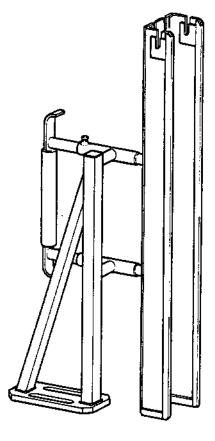
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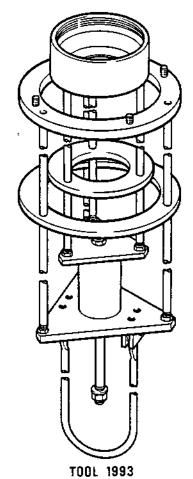
OVERHAUL



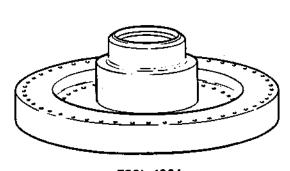
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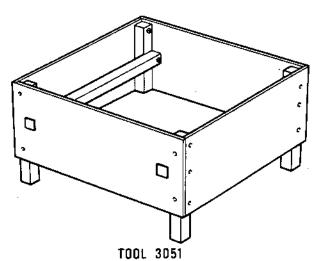
TOOL 1988 34.75 X 15.25 X 8.25 IN (885 X 390 X 210 MM)



46.25 X 11.00 IN DIA (1175 X 280 MM)



TOOL 1994 27.75 X 9.25 IN (705 X 235 MM)

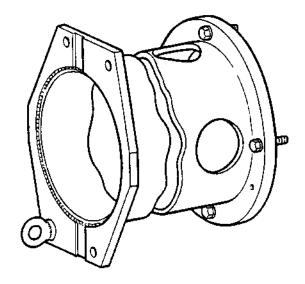


29.50 X 29.50 X 16.75 IN (750 X 750 X 430 MM)

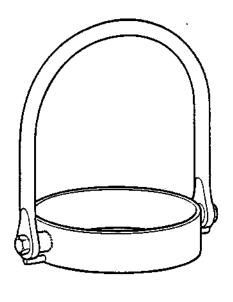
HP Compressor Assembly - Special Tools Figure 1036

SPECIAL TOOLS ETC

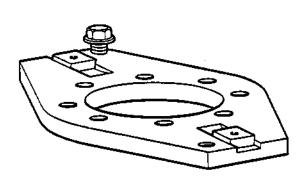
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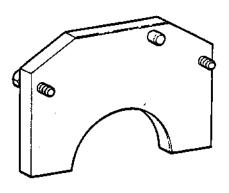
TOOL 1995 19.25 X 12.25 X 11.25 IN (490 X 315 X 290 MM)



TOOL 1996 10.25 X 9.00 X 7.25 IN DIA (265 X 230 X 185 MM)



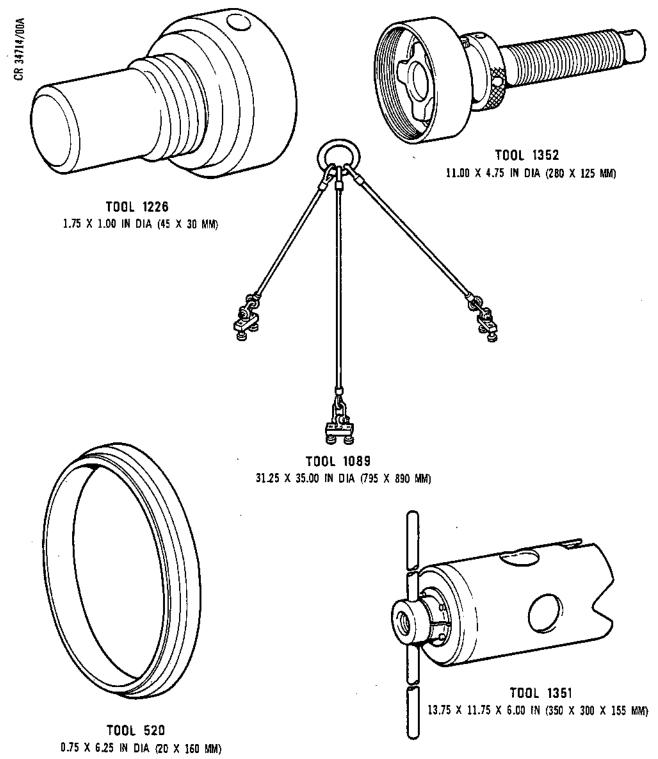
TOOL 1997 12.25 X 8.00 X 1.75 IN (315 X 205 X 45 MM)



TOOL 1998 8.00 X 5.50 X 2.00 IN (205 X 140 X 55 MM)

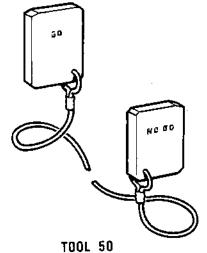
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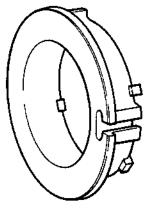


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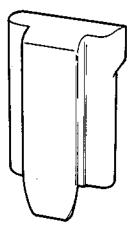




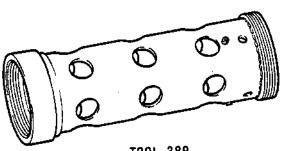
21.50 IN X 0.50 IN (550 X 15 MM)



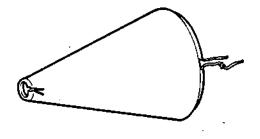
TOOL 990 1.75 X 6.50 IN DIA (45 X 170 MM)



TOOL 991 TOOL 1009 TOOL 1010 2.00 X 1.00 X 6.75 IN (55 X 30 X 20 MM)



TOOL 389 19.50 X 7.00 IN DIA (500 X 180 MM)

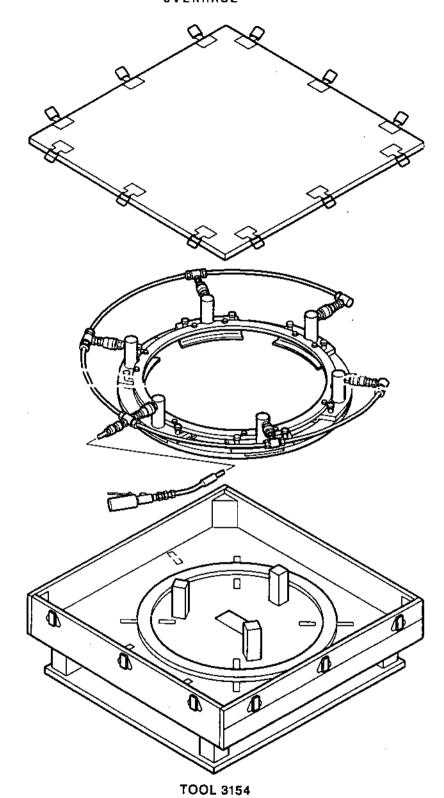


TOOL 210 57.00 X 44.00 IN DIA (1450 X 1120 MM)

SPECIAL TOOLS ETC

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HP Compressor Assembly - Special Tools Figure 1040

SPECIAL TOOLS ETC

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HP COMPRESSOR CASE AND VANES - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the HP compressor case and vanes.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. HP Compressor Case and Vanes Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---------------------------------|-------------|
| *1390 | P3c -861891 | Platform, container (1373) | 1001 |
| *137 3 | POJ.1077504 | Container, vanes | 1001 |
| *1053 | P3C.695734 | Sling, multiple leg, front case | 1001 |
| *1441 | POJ.868965 | Container, inner fixing rings | 1001 |

Disassembly Tools Table 1001

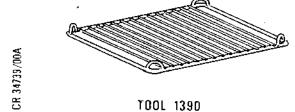


3. HP Compressor Case and Vanes Assembly Tools

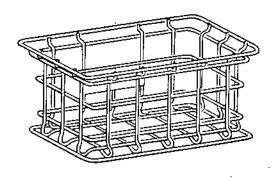
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---------------------------------|-------------|
| *1373 | POJ.1077504 | Container, vanes | 1001 |
| *1390 | P3C.861891 | Platform, container (1373) | 1001 |
| 289 | P3C.1073112 | Checking pin, probe vanes | 1001 |
| *1053 | P3C.695734 | Sling, multiple leg, front case | 1001 |
| *1441 | P0J.868965 | Container, inner fixing rings | 1001 |
| 1321 | P3C -893232 | Sleeve, bolt retaining ring | 1001 |
| 3134 | \$3\$15888000 | Tool, restraining | 1002 |
| 3135 | \$3\$15889000 | Protector, retaining | 1002 |
| 3136 | S3S15890000 | Protector, retaining | 1002 |

Assembly Tools Table 1002

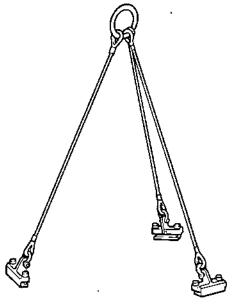
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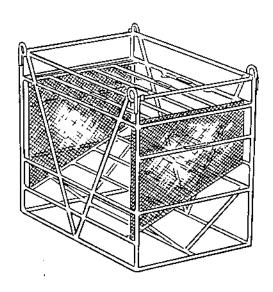
TOOL 139D 15.50 X 15.50 X 1.00 IN (395 X 395 X 30 MM)



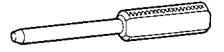
TOOL 1373 - 17.50 X 17.50 X 7.75 IN (445 X 445 X 200 MM)



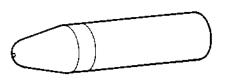
TOOL 1053 41.50 X 34.50 IN DIA (1055 X 880 MM)



TGOL 1441 35.50 X 31.00 X 24.25 IN (905 X 790 X 620 MM)



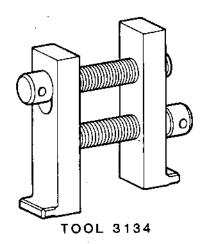
TOOL 289 3.50 X 0.50 IN DIA (90 X 15 MM)



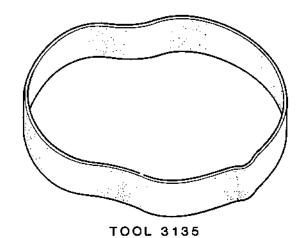
TOOL 1321 1.50 X 0.50 IN (40 X 15 MM)

HP Compressor Case and Vanes - Special Tools Figure 1001

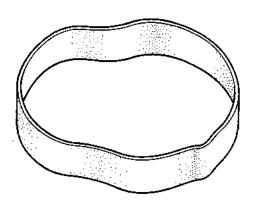
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3.00 X 2.25 X 0.75 IN (75 X 55 X 15 MM)



3.00 X 20.50 IN DIA (75 X 515 MM)



TOOL 3136 3.00 X 18.50 IN DIA (75 X 465 MM)

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HP COMPRESSOR ROTOR - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001, 1002, 1003 and 1004 are those required to disassemble, weigh blades and balance the HP compressor rotor.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and are duplicated in the tables.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. HP Compressor Rotor Disassembly Tools

| TOOL REF_NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 1676 | WJ.871057 | Support, disks, stage 1 | 1001 |
| 404 | P3C.1083350 | Multiple leg sling, stage 1 to 6 | 1001 |
| *1390 | P3C.861891 | Platform, container (1374 and 1373) | 1001 |
| 1374 | P3C.1077505 | Container, stage 1 to 4 blades | 1001 |
| *1418 | P0J.868931 | Container, stage 1 disk | 1002 |
| *1419 | POJ.868932 | Container, stage 2 to 6 disks | 1002 |
| 1166 | P3C.857325 | Retaining band, stage 3 to 6 blades | 1002 |
| *1373 | POJ.1077504 | Container, stage 5 and 6 blades | 1002 |
| 1420 | POJ.868934 | Container, cleaning, HP rotor shaft front | 1013 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|-----------------------|--|-------------|
| 1386 | POJ.1077519 | Fixture, cleaning, HP compressor labyrinth | 1013 |
| 1453 | P0J.868979 | Fixture, cleaning and storage | 1013 |
| 1502 | P0J.1255626 | Fixture, HP rotor air tubes | 1013 |
| 3143 | \$3\$20051000 | Tool, masking | 1014 |

Disassembly Tools Table 1001 (Concluded)

3. HP Compressor Rotor Blade Mass Moment Weigh

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 1273 | P3C.867007 | Locator, adapter arm (1272), HP blade mass moment weight | 1003 |
| 1272 | P3C.867006 | Adapter arm, HP blade mass moment weight | 1003 |

Mass Moment Weigh Tools Table 1002

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4. <u>HP Compressor Rotor Balancing Tools for Horizontal Balancing Procedure</u>

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|-----------------------|--|-------------|
| 371 | P3C.1083249 | Static balance mandrel, stage 1 disk | 1003 |
| 546 | P3C.1089009 | Static balance mandrel, stage 2 disk | 1003 |
| 1151 | P3C.1244774 | Static balance mandrel, stage 3 disk | 1004 |
| 1115 | P3C.1244775 | Static balance mandrel, stage 4 disk | 1004 |
| 1116 | P3C.1244776 | Static balance mandrel, stage 5 disk | 1004 |
| 1114 | P3C.1244773 | Static balance mandrel, stage 6 disk | 1004 |
| 552 | P3C.1089020 | Static balance mandrel, stage 7 disk | 1004 |
| 1500 | POJ.871100 | Protection guard, balancing | 1004 |
| 1171 | P3C.857331 | Lifting fixture, balancing mandrels | 1009 |
| 1673 | T.441007 | Hydraclamp, balancing mandrels, part of 924 | 1005 |
| 1674 | T.599065 | Pedestal, balancing mandrel Hydraclamp (1673), part of 924 | 1005 |

Balancing Tools Table 1003 (Continued)



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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|--|------|
| 924 | P3C.1223173 | Stand, assembly/disassembly | 1005 |
| 1163 | PJ.857314 | Mounting plate, Hydraclamp (1673), balancing mandrels | 1005 |
| 1667 | T.599635 | Support stand, balancing mandrels | 1005 |
| 547 | P3C.1089014 | Retaining bolt, balancing and blading mandrels | 100 |
| * 369 | PJ.1083239 | Lifting fixture, stage 1 disk | 100 |
| 1,165 | P3C.857324 | Mobile stand, HP disks/ balancing mandrels | 100 |
| 370 | P3C.1083248 | Blading mandrel, stage l disk | 100 |
| *1130 | P3C.699974 | Protection/retaining band, blades | 100 |
| *1655 | T.484702 | Hammer, blade retaining plates | 100 |
| *1173 | P3C.857335 | Multiple leg sling, stage 2 to 6 disks | 100 |
| 545 | PJ.1089008 | Blading mandrel, stage 2 disk | 100 |
| * 607 | PJ.1089098 | Locating pin, stage 3 disk/ spacer | 100 |
| * 608 | рј.1089099 | Support, locating pin (607, 606, 605 and 604) | 100 |
| * 757 | P3C.1089384 | Heater, HP disks | 100 |
| * 759 | P3C.1089386 | Mobile stand, heater (757) and control (758) | 100 |
| *1645 | PT.251081 | Multiple leg sling, heater (757) and mechanical pullers (457, 975, 1118, 1119 and 976) | 100 |
| * 758 | P3C.1089385 | Control, heater (757) | 100 |
| * 457 | P3C.1086801 | Mechanical puller, stage 2-3 spacer | 100 |
| * 458 | P3C.1086802 | Thrust bolt, mechanical puller (457) | 100 |
| * 460 | P3C.1086804 | Slave bolts, mechanical puller (457) | 100 |

Balancing Tools
Table 1003 (Continued)



| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| *1441 | POJ.868965 | Containers, spacer rings | 1008 |
| * 606 | PJ.1089097 | Locating pin, stage 4 and 5 disk/spacer | 1008 |
| * 471 | PJ.1244700 | Mechanical puller, stage 3-4 spacer | 1009 |
| * 474 | P3C.1086818 | Securing pin, mechanical pullers (975, 1118 and 1119) | 1009 |
| * 475 | P3C.1086819 | Slave bolt, mechanical pullers (975, 1118 and 1119) | 1009 |
| * 472 | PJ.1244694 | Mechanical puller, stage 4-5 spacer | 1009 |
| * 605 | PJ.1089096 | Locating pin, stage 6 disk/ spacer | 1009 |
| * 473 | PJ.1244698 | Mechanical puller, stage 5-6 spacer | 1009 |
| * 604 | PJ.1089095 | Locating pin, stage 7 disk/ spacer | 1010 |
| * 976 | PJ.1244695 | Mechanical puller, stage 6-7 spacer | 1010 |
| *1390 | P3C.861891 | Platform, container (1373 and 1374) | 1001 |
| *1373 | P3C.1077504 | Container, stage 7 blades | 1002 |
| *1419 | POJ.868932 | Container, stage 7 disk | 1002 |

Balancing Tools Table 1003 (Concluded)

5. HP Compressor Rotor Balancing Tools for Vertical Balancing Procedure

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|------------------------------------|------|
| 1825 | PDJ.891319 | Balancing adapter, stage 1 | 1010 |
| 1841 | PDJ.1237526 | Location pins | 1010 |
| * 369 | P3C.1083239 | Lifting fixture stage l disk | 1005 |
| *1418 | P3C.868931 | Container, stage 1 disk | 1002 |
| *1130 | P3C.699974 | Protection/retaining bands, blades | 1006 |

Balancing Tools Table 1004 (Continued)

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DMMPN 509 mk.610-14-28 overhaul



| #1655 T.484702 Hammer, blade retaining 100 plates 1827 PDJ.894948 Balancing adapter 100 2 to 6 disks 2 to 6 disks 2 to 6 disks 3 to 607 P3C.1089098 Locating pin, stages 2 to 6 disks 4 607 P3C.1089099 Support, locating pin (604, 100 605, 606 and 607) 4 teater, HP disks 100 605, 606 and 607) 5 The part of part | TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|--|-----------------|-----------------------|---|------|
| #1655 T.484702 Hammer, blade retaining plates #1827 PDJ.894948 Balancing adapter 100 #1173 P3C.857335 Multiple leg sling, stages 100 2 to 6 disks #1419 P3C.868932 Container, stages 2 to 6 disks #1607 P3C.1089098 Locating pin, stage 3 disk/ 100 spacer #1757 P3C.1089384 Heater, HP disks 100 #1757 P3C.1089386 Mobile stand, heater (757) and control (758) #1645 PT.251081 Multiple leg sling, heater (757) and mechanical pullers (457, 975, 976, 1118 and 1119) #1758 P3C.1089385 Control, heater (757) 100 #1828 PDJ.1238788 Slave bolts, stage 3 disk 100 #1840 PDJ.1238374 Balancing adapter, stages 100 #1840 PDJ.1238374 Balancing adapter, stages 100 #1840 PDJ.123865 Adjusting washer, stage 3 disk/ 100 #1840 PDJ.123866 Adjusting washer, stage 3 disk/ spacer #1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer #1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer #1845 P3C.1086801 Mechanical puller, stage 2-3 for spacer #1857 P3C.1086801 Mechanical puller, stage 2-3 for spacer #1858 P3C.1086802 Thrust bolt, mechanical puller (457) #1840 P3C.1086804 Slave bolts, mechanical 100 #1841 P3C.868965 Containers, spacer rings 100 #1841 P3C.868965 Containers, spacer rings 100 | 1826 | PDJ.855908 | | 1010 |
| #1173 | *1655 | T.484702 | Hammer, blade retaining | 1006 |
| #1173 P3C.857335 Multiple leg sling, stages 2 to 6 disks *1419 P3C.868932 Container, stages 2 to 6 disks *607 P3C.1089098 Locating pin, stage 3 disk/ locating pin, stage 3 disk/ locating pin (604, locating pin (757) locating, locating pin (604, locating locating pin (604, locating pin (604, locating locating locating locating pin (604, locating locat | 1827 | PDJ.894948 | Balancing adapter | 1010 |
| disks Coating pin, stage 3 disk Doase | *1173 | P3C.857335 | Multiple leg sling, stages | 100 |
| # 608 P3C.1089099 Support, locating pin (604, location for form for for form for form for form for | *1419 | P3C.868932 | | 1002 |
| 605, 606 and 607) F3C.1089384 Heater, HP disks 106 F759 P3C.1089386 Mobile stand, heater (757) and control (758) Multiple leg sling, heater (757) and mechanical pullers (457, 975, 976, 1118 and 1119) F758 P3C.1089385 Control, heater (757) 106 1828 PDJ.1238788 Slave bolts, stage 3 disk 107 and 2-3 spacer 209 PDJ.1067563 Adapter hub, balancing 107 adapter (1840) 1840 PDJ.1238374 Balancing adapter, stages 107 3 to 7 HP disks and spacers 1829 PDJ.1239655 Location pins, stage 3 disk/ spacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer Retaining plate, stage 3 disk/spacer Retaining plate, stage 3 location pins plate, stage 3 disk/spacer F457 P3C.1086801 Mechanical puller, stage 2-3 location pins plate, stage 3 location pins plate, stage 2-3 location pins pl | * 607 | P3C.1089098 | | 1007 |
| # 759 P3C.1089386 Mobile stand, heater (757) 100 and control (758) # 1645 PT.251081 Multiple leg sling, heater (757) and mechanical pullers (457, 975, 976, 1118 and 1119) # 758 P3C.1089385 Control, heater (757) 100 and 2-3 spacer # 209 PDJ.1067563 Adapter hub, balancing 100 adapter (1840) # 1840 PDJ.1238374 Balancing adapter, stages 100 adapter (1840) # 1829 PDJ.1239655 Location pins, stage 3 disk/spacer # 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer # 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer # 257 P3C.1086801 Mechanical puller, stage 2-3 100 spacer # 258 P3C.1086802 Thrust bolt, mechanical puller (457) # 250 P3C.1086804 Slave bolts, mechanical puller (457) # 260 P3C.1086805 Containers, spacer rings 100 spacer rings | * 608 | | Support, locating pin (604, 605, 606 and 607) | 100 |
| # 759 P3C.1089386 Mobile stand, heater (757) and control (758) # 1645 PT.251081 Multiple leg sling, heater (757) and mechanical pullers (457, 975, 976, 1118 and 1119) # 758 P3C.1089385 Control, heater (757) log and 2-3 spacer # 209 PDJ.1067563 Adapter hub, balancing adapter (1840) # 1840 PDJ.1238374 Balancing adapter, stages 3 to 7 HP disks and spacers # 1829 PDJ.1239655 Location pins, stage 3 disk/spacer # 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer # 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer # 257 P3C.1086801 Mechanical puller, stage 2-3 for spacer # 258 P3C.1086802 Thrust bolt, mechanical puller (457) # 260 P3C.1086804 Slave bolts, mechanical puller (457) # 261441 P3C.868965 Containers, spacer rings | * 757 | | Heater, HP disks | 1001 |
| (757) and mechanical pullers (457, 975, 976, 1118 and 1119) 758 P3C.1089385 Control, heater (757) 106 1828 PDJ.1238788 Slave bolts, stage 3 disk 106 and 2-3 spacer 209 PDJ.1067563 Adapter hub, balancing 106 adapter (1840) 1840 PDJ.1238374 Balancing adapter, stages 106 3 to 7 HP disks and spacers 1829 PDJ.1239655 Location pins, stage 3 disk/ 106 spacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 1857 P3C.1086801 Mechanical puller, stage 2-3 106 spacer Thrust bolt, mechanical 106 puller (457) 1840 P3C.1086804 Slave bolts, mechanical 106 puller (457) 1841 P3C.868965 Containers, spacer rings 106 | | | | 100 |
| 1828 PDJ.1238788 Slave bolts, stage 3 disk and 2-3 spacer 209 PDJ.1067563 Adapter hub, balancing adapter (1840) 1840 PDJ.1238374 Balancing adapter, stages 3 to 7 HP disks and spacers 1829 PDJ.1239655 Location pins, stage 3 disk/spacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 18457 P3C.1086801 Mechanical puller, stage 2-3 location pins stage 3 location pins st | *1645 | PT.251081 | (757) and mechanical pullers (457, 975, 976, 1118 | 100' |
| 1828 PDJ.1238788 Slave bolts, stage 3 disk and 2-3 spacer 209 PDJ.1067563 Adapter hub, balancing adapter (1840) 1840 PDJ.1238374 Balancing adapter, stages 3 to 7 HP disks and spacers 1829 PDJ.1239655 Location pins, stage 3 disk/ losspacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 2457 P3C.1086801 Mechanical puller, stage 2-3 losspacer 2458 P3C.1086802 Thrust bolt, mechanical puller (457) 2460 P3C.1086804 Slave bolts, mechanical puller (457) 2411 P3C.868965 Containers, spacer rings 100000000000000000000000000000000000 | * 758 | P3C.1089385 | Control, heater (757) | 1008 |
| 209 PDJ.1067563 Adapter hub, balancing adapter (1840) 1840 PDJ.1238374 Balancing adapter, stages 3 to 7 HP disks and spacers 1829 PDJ.1239655 Location pins, stage 3 disk/ spacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 1831 PDJ.1238796 Mechanical puller, stage 2-3 100 spacer 18457 P3C.1086801 Mechanical puller, stage 2-3 100 spacer 1858 P3C.1086802 Thrust bolt, mechanical puller (457) 1859 P3C.1086804 Slave bolts, mechanical puller (457) 1850 P3C.868965 Containers, spacer rings 100 puller (457) | 1828 | PDJ.1238788 | Slave bolts, stage 3 disk | 101 |
| 1840 PDJ.1238374 Balancing adapter, stages 3 to 7 HP disks and spacers 1829 PDJ.1239655 Location pins, stage 3 disk/ 105 spacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 18457 P3C.1086801 Mechanical puller, stage 2-3 for spacer 1858 P3C.1086802 Thrust bolt, mechanical puller (457) 1859 P3C.1086804 Slave bolts, mechanical puller (457) 1850 P3C.868965 Containers, spacer rings 100 | 209 | PDJ.1067563 | Adapter hub, balancing | 1011 |
| 1829 PDJ.1239655 Location pins, stage 3 disk/ 103 spacer 1830 PDJ.1239656 Adjusting washer, stage 3 disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 disk/spacer 18457 P3C.1086801 Mechanical puller, stage 2-3 100 spacer 1858 P3C.1086802 Thrust bolt, mechanical puller (457) 1859 P3C.1086804 Slave bolts, mechanical puller (457) 1850 P3C.868965 Containers, spacer rings 100 | 1840 | PDJ.1238374 | Balancing adapter, stages | 1011 |
| disk/spacer 1831 PDJ.1238796 Retaining plate, stage 3 103 disk/spacer 457 P3C.1086801 Mechanical puller, stage 2-3 100 spacer 458 P3C.1086802 Thrust bolt, mechanical puller (457) 460 P3C.1086804 Slave bolts, mechanical puller (457) F1441 P3C.868965 Containers, spacer rings 100 | 1829 | PDJ.1239655 | Location pins, stage 3 disk/ | 101 |
| disk/spacer 457 P3C.1086801 Mechanical puller, stage 2-3 100 spacer 458 P3C.1086802 Thrust bolt, mechanical loo puller (457) 460 P3C.1086804 Slave bolts, mechanical puller (457) P3C.868965 Containers, spacer rings 100 | | PDJ.1239656 | Adjusting washer, stage 3 disk/spacer | 1011 |
| spacer 458 P3C.1086802 Thrust bolt, mechanical loc puller (457) 460 P3C.1086804 Slave bolts, mechanical loc puller (457) 91441 P3C.868965 Containers, spacer rings loc | 1831 | PDJ.1238796 | Retaining plate, stage 3 | 1013 |
| P3C.1086802 Thrust bolt, mechanical 100 puller (457) F460 P3C.1086804 Slave bolts, mechanical 100 puller (457) F1441 P3C.868965 Containers, spacer rings 100 | * 457 | P3C.1086801 | Mechanical puller, stage 2-3 | 1008 |
| 7 460 P3C.1086804 Slave bolts, mechanical 100 puller (457) T1441 P3C.868965 Containers, spacer rings 100 | * 458 | P3C.1086802 | Thrust bolt, mechanical | 1008 |
| 1441 P3C.868965 Containers, spacer rings 100 | * 460 | P3C.1086804 | Slave bolts, mechanical | 1008 |
| | 1441 | P3C.868965 | | 1008 |
| TOCALING DINS, SCAUE 4 AND THE | * 606 | P3C.1089097 | Locating pins, stage 4 and | 1008 |

Balancing Tools
Table 1004 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 1832 | PDJ.1238789 | Slave bolts, stage 4 and 5 disk/spacer | 1011 |
| 1833 | PDJ.1238793 | Location pins, stage 4 disk/ spacer | 1012 |
| * 471 | PJ.1244700 | Mechanical puller, stage 3-4 spacer | 1009 |
| * 474 | P3C.1086818 | Securing pin, mechanical puller (975, 1118 and 1119) | 1009 |
| * 475 | P3C.1086819 | Slave bolt, mechanical puller (975, 1118 and 1119) | 1009 |
| 1835 | PDJ.1238794 | Location pin, stage 5 disk/ spacer | 1012 |
| * 472 | PJ.1244694 | Mechanical puller, stage 4-5 spacer | 1009 |
| * 605 | P3C.1089096 | Locating pin, stage 6 disk/ spacer | 1009 |
| 1836 | PDJ.1238790 | Slave bolts, stage 6 disk/ spacer | 1012 |
| 1837 | PDJ.1238795 | Location pins, stage 6 disk/ spacer | 1012 |
| * 473 | P3C.1244698 | Mechanical puller, stage 5-6 spacer | 1009 |
| * 604 | P3C.1089095 | Locating pin, stage 7 disk/ spacer | 1010 |
| 1838 | PDJ.1238344 | Location pins, stage 7 disk/ | 1012 |
| * 976 | P3C.1244695 | <pre>spacer Mechanical puller, stage 6-7 spacer</pre> | 1010 |
| 1839 | PDJ.1238341 | Retaining plate, stage 7 disk | 1012 |
| *1390 | P3C.861891 | Platform, container (1373) | 1001 |
| *1373 | P3C.1077504 | Container, stage 7 blades | |
| 1419 | POJ.868932 | Container, stage 7 blades Container, stage 7 disk | 1002 |

Balancing Tools Table 1004 (Concluded)

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6. HP Compressor Rotor Tools for In-situ Blade Blending

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. No. |
|-----------------|--------------------------|---------------------------------|-------------|
| *3146 | s3s20282000 | Kit, Blade Blending | 1015 |
| *3169 | \$3\$20592000 | Training Aid, Blade Blending | 1015 |

In-situ Blade Blending Tools Table 1005

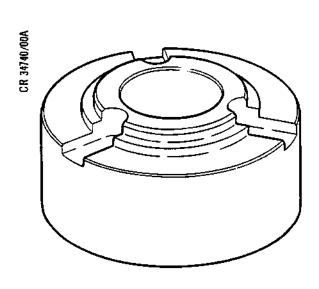


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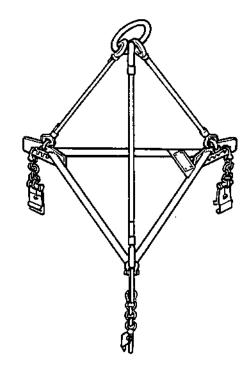
SPECIAL TOOLS ETC.

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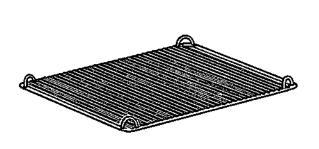
Dec 1/97



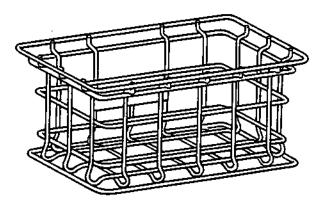
TOOL 1676 7.00 X 14.50 IN DIA (180 X 370 MM)



TOOL 404 46.00 X 26.50 X 22.75 IN (1170 X 675 X 580 MM)



TOOL 1390 15.50 X 15.50 X 1.00 IN (395 X 395 X 30 MM)

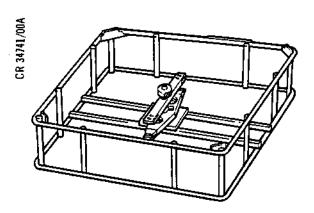


TOOL 1374 17.75 X 17.75 X 10.75 IN (455 X 455 X 275 MM)

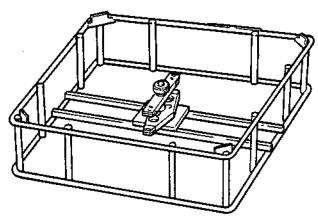
HP Compressor Rotor - Special Tools Figure 1001

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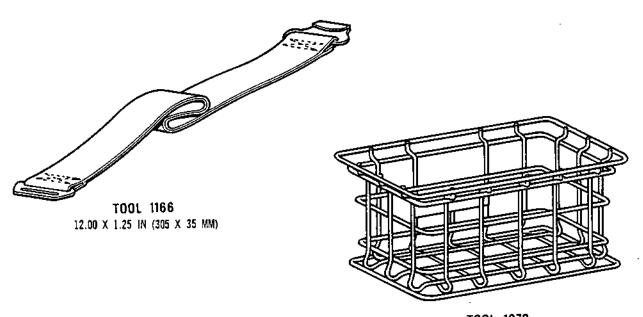




TOOL 1418 21.75 X 21.75 X 5.50 IN (555 X 555 X 140 MM)



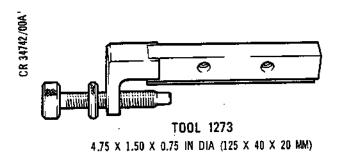
TOOL 1419 28.75 X 28.75 X 6.00 IN (735 X 735 X 155 MM)

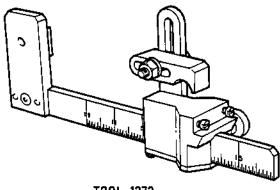


TOOL 1373 17.50 X 17.50 X 7.75 IN (445 X 445 X 200 MM)

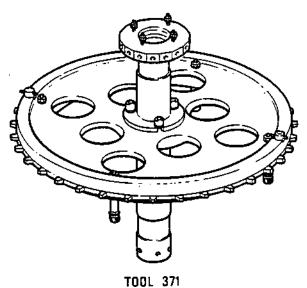
HP Compressor Rotor - Special Tools Figure 1002

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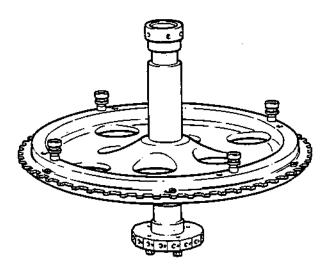




TOOL 1272 9.00 X 3.75 X 2.00 IN (230 X 100 X 55 MM)



15.75 X 17.75 IN DIA (405 X 455 MM)

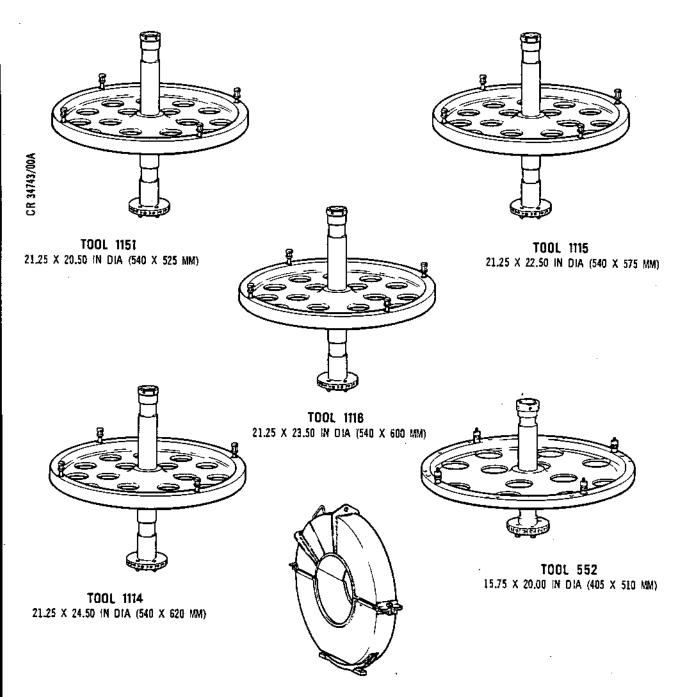


TOOL 546 15.75 X 19.75 IN DIA (405 X 505 MM)

HP Compressor Rotor - Special Tools Figure 1003

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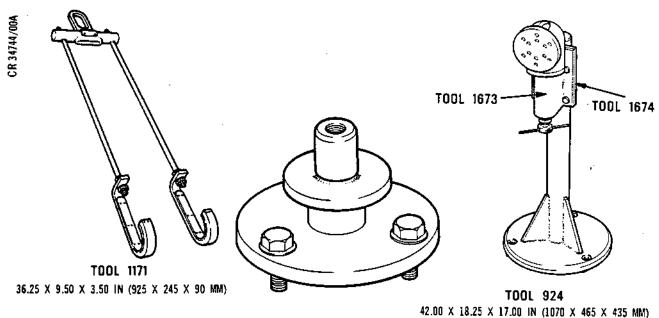


TOOL 1500 47.50 X 46.50 X 9.25 IN (1210 X 1185 X 235 MM)

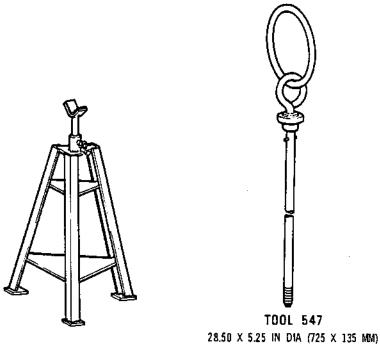
HP Compressor Rotor - Special Tools Figure 1004

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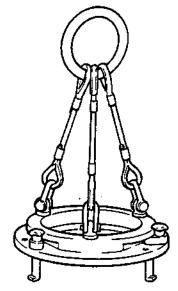




TOOL 1163 5.25 X 6.50 IN DIA (135 X 170 MM)



TOOL 1667 37.00 X 18.50 X 16.50 IN (940 X 470 X 420 MM)



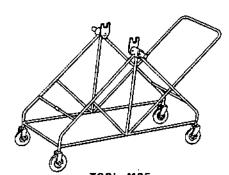
TOOL 369 20.00 X 11.50 IN DIA (510 X 295 MM)

HP Compressor Rotor - Special Tools Figure 1005

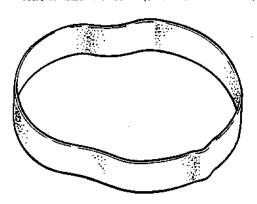
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OVERHAUL

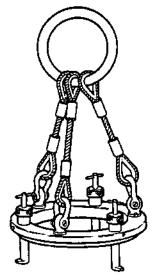




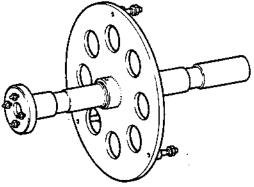
TOOL 1165 60.50 X 41.25 X 34.50 IN (1540 X 1050 X 880 MM)



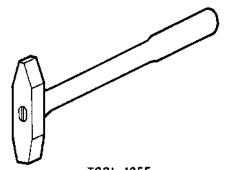
TOOL 1130 4.00 X 28.00 IN DIA (105 X 715 MM)



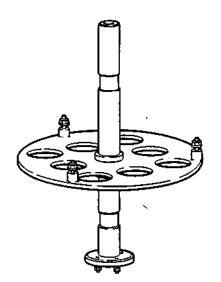
TOOL 1173 18.50 X 9.50 IN DIA (470 X 245, MM)



TOOL 370 24.50 X 16.00 IN DIA (625 X 410 MM)



TOOL 1655 12.00 X 4.50 X 1.00 IN (305 X 115 X 30 MM)



TOOL 545 24.50 X 17.75 IN DIA (625 X 455 MM)

HP Compressor Rotor - Special Tools Figure 1006

TN40912

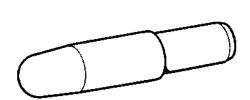


OMMBO 214-28

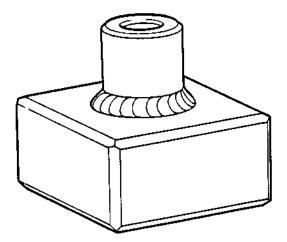
MK.610-14-28 OVERHAUL



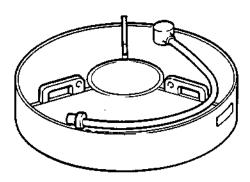
CR 34746/00A



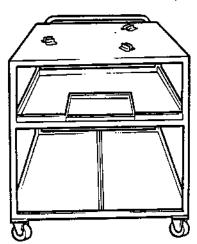
TOOL 607 2.00 X 0.50 IN DIA (55 X 15 MM)



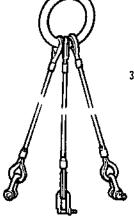
TOOL 608 3.00 \times 3.00 \times 2.25 IN (80 \times 80 \times 60 MM)



TOOL 757 6.75 X 29.75 IN DIA (175 X 760 MM)



TOOL 759 38.00 X 34.00 X 33.50 IN (970 X 865 X 855 MM)



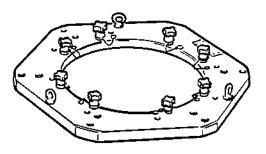
TOOL 1645 36.50 X 3.00 (N (930 X 80 MM)

HP Compressor Rotor - Special Tools Figure 1007

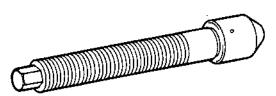
72-33-02

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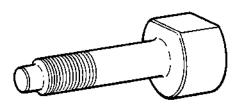
TOOL 758 13.00 X 12.00 X 10.25 IN (335 X 305 X 265 MM)



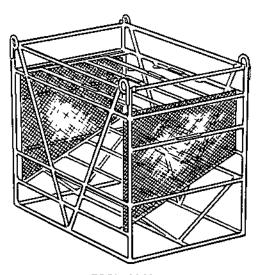
TOOL 457 19.50 X 2.25 X 22.00 IN DIA (500 X 60 X 560 MM)



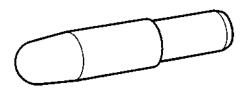
TOOL 458 5.00 X 0.75 IN DIA (130 X 20 MM)



TOOL 460 2.00 X 1.00 IN DIA (55 X 30 MM)



TOOL 1441 35.50 X 31.00 X 24.25 IN (905 X 790 X 620 MM)

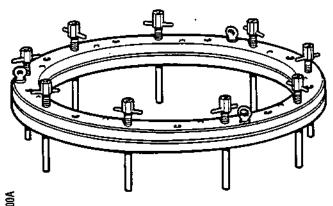


TOOL 606 2.00 X 0.50 IN DIA (55 X 15 MM)

HP Compressor Rotor - Special Tools Figure 1008

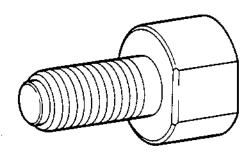
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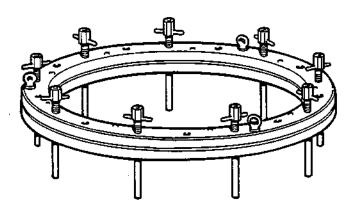


TOOL 474 4.00 X 2.06 X 1.90 IN DIA (105 X 55 X 30 MM)

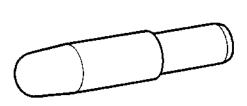
TOOL 471 6.50 X 21.00 IN DIA (170 X 535 MM)



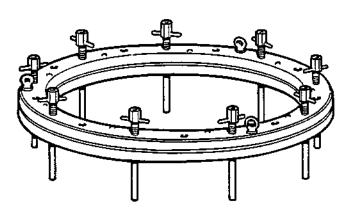
TOOL 475 1,50 X 1.00 IN DIA (40 X 30 MM)



TOOL 472 6.25 X 23.00 IN DIA (160 X 585 MM)



TOOL 605 2.00 X 0.50 IN DIA (55 X 15 MM)



TOOL 473 6.00 X 24.00 IN DIA (155 X 610 MM)

HP Compressor Rotor - Special Tools Figure 1009

SPECIAL TOOLS ETC

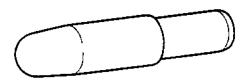
Z-33-UZ Page 1015 Aug 1/78



OLYMPUS 593

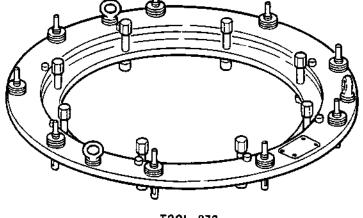
MK.610-14-28 OVERHAUL



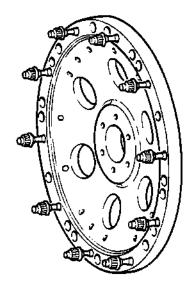


TOOL 604 2.50 X 0.50 IN DIA (65 X 15 MM)

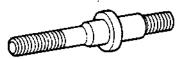
CR 34749/00A



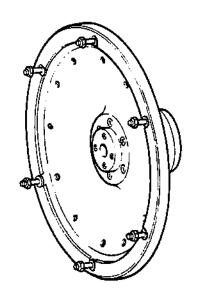
TOOL 9763.50 X 24.75 IN DIA (90 X 630 MM)



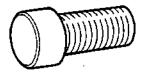
TOOL 1825 3.75 X 16.00 IN DIA (100 X 410 MM)



TOOL 1841 3.00 X 0.75 IN DIA (80 X 20 MM)



TOOL 1827 6.75 X 18.00 IN DIA (175 X 460 MM)



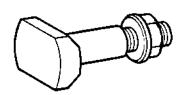
TOOL 1826 0.75 X 1.50 IN DIA (20 X 40 MM)

HP Compressor Rotor - Special Tools Figure 1010

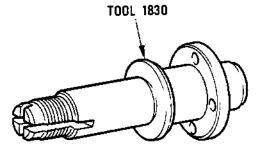
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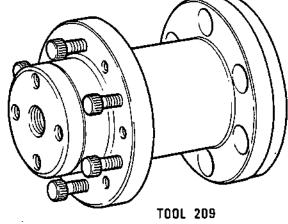
CR 34750/00A



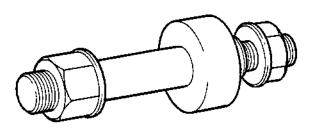
TOOL 1828 1.50 X 1.00 IN DIA (40 X 30 MM)



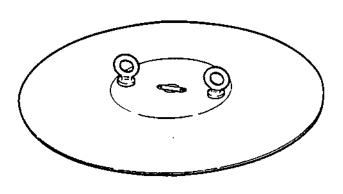
TOOL 1840 8.25 X 3.00 IN DIA (210 X 80 MM)



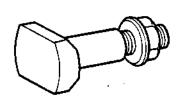
4.75 X 5.00 IN DIA (125 X 130 MM)



TOOL 1829 2.50 X 0.75 IN DIA (65 X 20 MM)



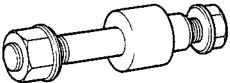
TOOL 1831 6.75 X 27.00 IN DIA (175 X 690 MM)



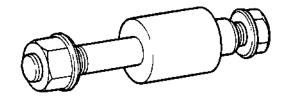
. TOOL 1832 1.50 X 1.00 IN DIA (40 X 30 MM)

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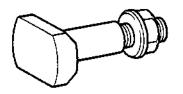
OVERHAUL



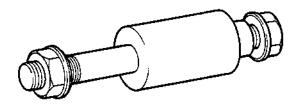
TOOL 1833 2.75 X 0.75 IN DIA (70 X 20 MM)



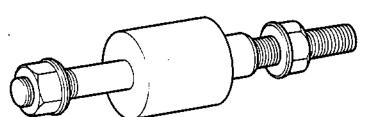
TOOL 1835 3.25 X 0.75 IN DIA (85 X 20 MM)



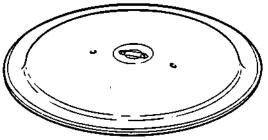
TOOL 1836 1.75 X 1.00 IN DIA (45 X 30 MM)



TOOL 1837 3.50 X 0.75 IN DIA (90 X 20 MM)



TOOL 1838 4.50 X 1.00 IN DIA (115 X 30 MM)

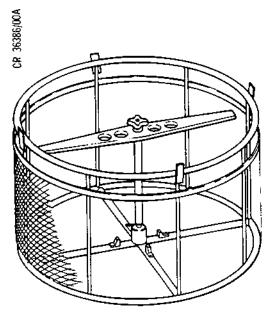


TOOL 1839 3.50 X 27.00 IN DIA (90 X 690 MM)

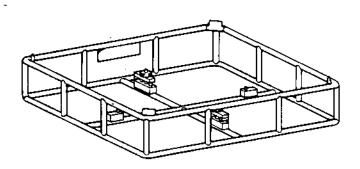
HP Compressor Rotor - Special Tools Figure 1012

SPECIAL TOOLS ETC

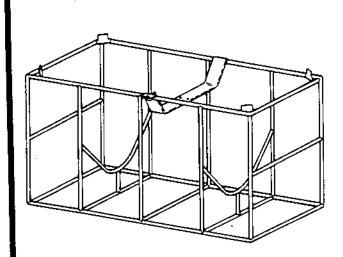
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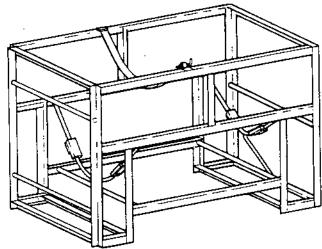
TOOL 1420 13.25 × 20.75 IN DIA (337 × 527 MM DIA)



TOOL 1386 25.00 × 25.00 × 5.00 N (635 × 635 × 127 MM)



TOOL 1502 27.00 × 14.00 × 14.50 IN (686 × 356 × 368 MM)



TOOL 1453 $38.00 \times 24~00 \times 25.00$ IN (965 $\times~610~\times~635$ MM)

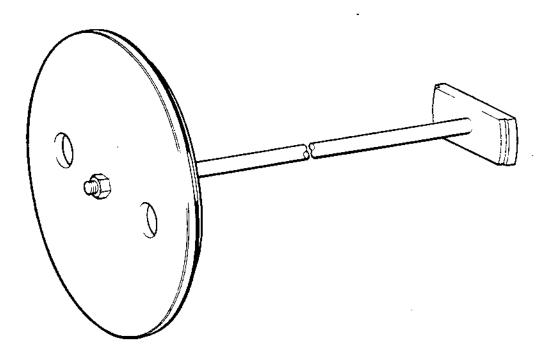
HP Compressor Rotor - Special Tools Figure 1013

SPECIAL TOOLS ETC

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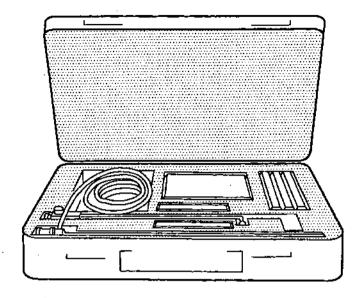


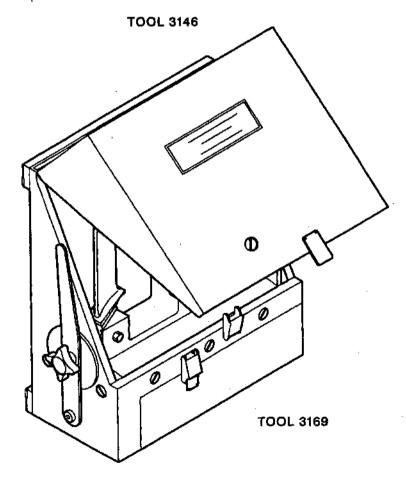
TOOL 3143 33.25 X 14.00 IN DIA (845 X 356 MM)

HP Compressor Rotor - Special Tools Figure 1014

SPECIAL TOOLS ETC

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HP Compressor Rotor - Special Tools Figure 1015

SPECIAL TOOLS ETC

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HP TURBINE ROTOR - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Tables 1001 and 1002 are those required to disassemble and assemble the HP turbine rotor.
- B. The tools have been listed in order of usage, and the Tool Ref. No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

HP Turbine Rotor Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|------------------------------------|------|
| *1113 | P3C.699963 | Lifting fixture, turbine wheel | 1001 |
| * 139 | PJ.871077 | Balancing mandrel, turbine wheel | 1001 |
| *1111 | P3C.699961 | Mobile stand, turbine wheel | 1001 |
| *1135 | P3C.699989 | Extension, mandrel (139) | 1001 |
| 1 120 | P3C.699964 | Lifting fixture, turbine wheel | 1001 |
| 1082 | PJ.1246961 | Pallet, turbine wheel | 1001 |
| * 954 | P3C.1229360 | Platform stand, blading fixture | 1002 |
| 1122 | PJ.699966 | Blading fixture, turbine disk | 1002 |
| 1080 | PJ.1246870 | Locking tool, blade locking plates | 1002 |
| 1081 | PJ.1246871 | Locking tool, blade locking plates | 1002 |
| 907 | PT.1234482 | Driver, turbine blades | 1002 |
| 1425 | POJ.868947 | Container, turbine blades | 1002 |
| 1141 | P3C.850927 | Lifting fixture, turbine disk | 1003 |
| 1437 | POJ.868961 | Mandrel, lifting fixture | 1003 |
| 1439 | POJ.868963 | Inspection stand, turbine disk | 1003 |
| 1061 | P3C.695746 | Protector, turbine rear labyrinth | 1003 |
| 1062 | P3C.695747 | Protector, turbine hub labyrinth | 1003 |
| 1063 | P3C.695748 | Protector, turbine front labyrinth | 1003 |

Disassembly Tools Table 1001

SPECIAL TOOLS ETC.



3. HP Turbine Rotor Assembly Tools

| TOOL REF.NG. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 390 | P3C.1083274 | Fixture, pressure wash | 1004 |
| 754 | P3C.1089369 | Support bracket, wash tank | 1004 |
| *1425 | POJ.868947 | Container, turbine blades | 1002 |
| 15 | P3C.1072872 | Adapter, blade moment weighing | 1004 |
| 267 | P3C.1073060 | Container, adapter (15) | 1004 |
| 11 | P3C.1072868 | Adapter arm, moment weighing (15) | 1004 |
| 169 | PJ.1072874 | Container, adapter arm (11) | 1004 |
| 33 | PG.1223021 | Squared graticule, balancing | |
| | | machine | 1005 |
| 27 | P3C.1073067 | Balance weight, adapter (15) | 1005 |
| 1274 | P3C.867008 | Locator, adapter arm (1272) | 1005 |
| 1272 | P3C.867006 | Adapter arm, moment weighing | 1005 |
| *1113 | PJ.699962 | Lifting fixture, turbine wheel | 1001 |
| * 139 | POJ.871077 | Balancing mandrel, turbine wheel | 1001 |
| *1111 | P3C.699961 | Mobile stand, turbine wheel | 1001 |
| 1121 | P3C.699965 | Lifting ring, balancing mandrel (139) | 1005 |
| *1120 | P3C.699964 | Lifting fixture, turbine wheel | 1001 |
| *1082 | PJ.1246961 | Pallet, turbine wheel | 1001 |
| *1122 | P3C699966 | Blading fixture, turbine disk | 1002 |
| * 907 | PT.1234482 | Driver, turbine blades | 1002 |
| * 954 | PJ.1229360 | Platform stand, blading fixture | 1002 |
| *1135 | PJ.699989 | Extension, mandrel (139) | 1001 |
| 1637 | T.225613 | Adjustable bearing, balancing machine | 1005 |
| 1131 | P3C.699975 | Lifting fixture, balancing mandrel (139) | 1006 |
| 1641 | T.225614 | Gauge, adjustable bearing (1637) | 1006 |
| 1652 | P3C.443496 | Bearing housing, balancing | |
| | 100000 | machine | 1006 |
| 363 | PJ.1083233 | Slave bearing, balancing machine | 1006 |
| 1642 | T.599772 | Shroud, protection, turbine rotor | 1006 |
| *1080 | PJ.1246870 | Locking tool, blade locking plates | 1002 |
| *1081 | PJ.1246871 | Locking tool, blade locking plates | 1002 |
| *1061 | P3C.695746 | Protector, turbine rear labyrinth | 1003 |
| *1062 | P3C.695747 | Protector, turbine hub | 1003 |
| *1063 | P3C.695748 | Protector, turbine front | |
| | | labyrinth | 1003 |

Sub-Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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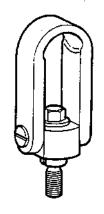
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|---|---|----------------------|
| 3052 | P5J.871901) S3S.15261000) | Balancing mandrel, turbine rotor | 1006 |
| 3053 | P5J.1294517) S3S.15624000) | Stand, turbine rotor assembly | 1007 |
| 3066 3054 | S3S.15337000 PJ.871905) | Container, mandrel (3052) Lifting equipment, balancing | 1007 |
| 3055 | S3S.15622000) P5J.1297496) | mandrel (3052) Transport stand (3053, 3054) | 1007 1007 |
| 3056 3057 | S3S.15627000) P5J.1294516 P5J.1294519 | Mechanical puller, hub | 1007 |
| 1022 3058 | PJ.684642 PJJ.1294520 | Torque spanner, hub nut Torque multiplier, (3057) Adapter plate, (1022) | 1007 1008 1008 |
| 3059 1073 | P5J.1294518 PJ.695763 | Restrainer, (3058) Adjustable bearing, support | 1008 |
| 1666 1630 | T.595124 PT.898073 | Loading fixture, mandrel Cranked ring wrench, rotor nuts | 1008 |
| 1057 3067 | PJ.695740 S3S.15259000 | Lifting/extracting fixture, hub Slave turbine disk, balancing | 1009 1009 |
| 3069 | S3S.15335000 | Container, slave turbine disk (3069) | 1009 |
| 3068 | PJ.1065028 | Shroud, protection, turbine rotor | 1009 |

Sub-Assembly Tools Table 1002 (Concluded)

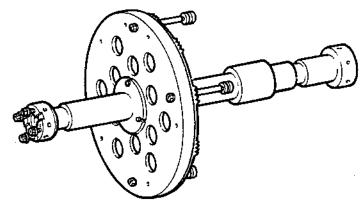
SPECIAL TOOLS ETC.



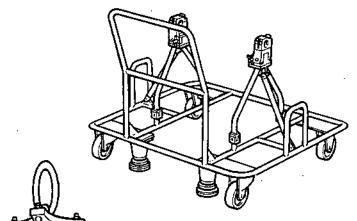
CR 34780/30A



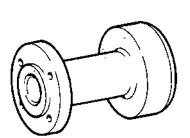
TOOL 1113 5.50 X 2.75 X 1.75 IN DIA (140 X 70 X 45 MM)



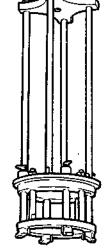
TOOL 139
31.00 X 15.50 IN DIA (790 X 395 MM)



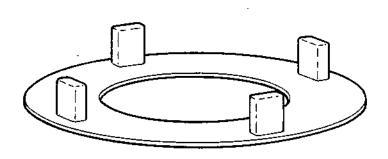
TOOL 1111 52.50 X 45.25 X 44.00 IN (1335 X 1150 X 1120 MM)



TOOL 1135 5.25 X 3.25 IN DIA (135 X 85 MM)



TOOL 1120 28.25 X 7.50 IN (720 X 195 MM)



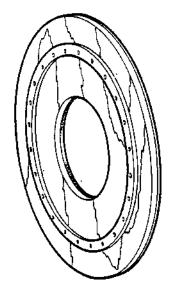
TOOL 1082 2.75 X 24.00 IN DIA (70 X 610 MM)

HP Turbine Rotor - Special Tools Figure 1001

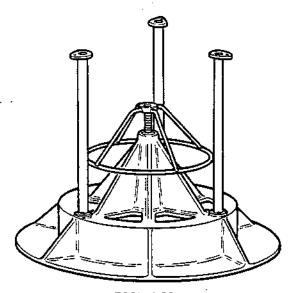
SPECIAL TOOLS ETC.

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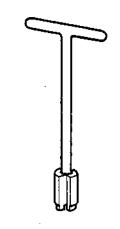
CR 34781/00A



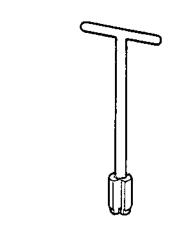
TOOL 954 1.25 X 47.00 IN DIA (35 X 1195 MM)



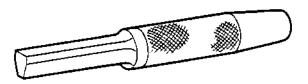
TOOL 1122 37.75 X 48.00 IN DIA (960 X 1220 MM)



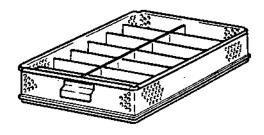
TOOL 1080 7.00 X 2.75 X 0.50 IN (180 X 70 X 15 MM) L.H.



TOOL 1081 4.00 x 2.75 x 0.50 IN (105 x 70 x 15 MM) R.H.



TOOL 907 8.25 X 1.00 IN DIA (210 X 30 MM)



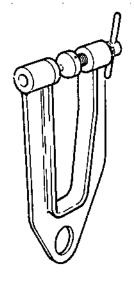
TOOL 1425 23.00 X 15.75 X 3.75 IN (585 X 405 X 100 MM)

HP Turbine Rotor - Special Tools Figure 1002

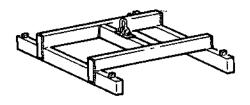
SPECIAL TOOLS ETC.

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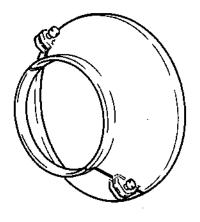
Page 1005 Dec 1/78 CR 34782/00A



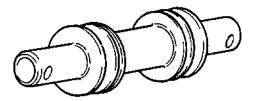
TOOL 1141 25.25 X 13.75 X 2.50 IN (645 X 350 X 65 MM)



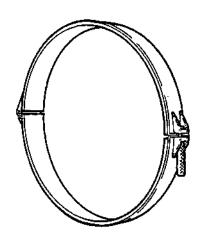
TOOL 1439 55.00 X 43.00 X 13.00 IN (1400 X 1095 X 335 MM)



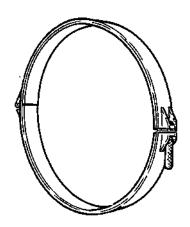
TOOL 1062 4.75 X 12.50 IN DIA (125 X 320 MM)



TOOL 1437 15.00 X 3.00 IN DIA (385 X 80 MM)



TOOL 1061 2.25 X 19.00 IN DIA (60 X 485 MM)



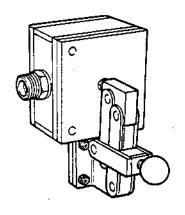
TOOL 1063 1.75 X 19.75 IN DIA (45 X 505 MM)

HP Turbine Rotor - Special Tools Figure 1003

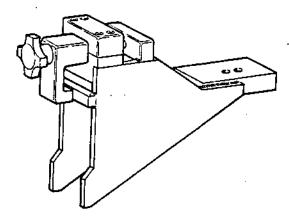
SPECIAL TOOLS ETC.

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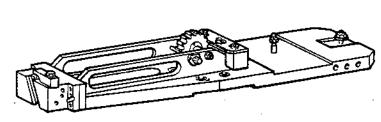
CR 34783/00A



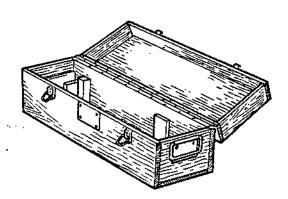
TOOL 390 7.00 X 5.75 X 4.50 IN (180 X 150 X 115 MM)



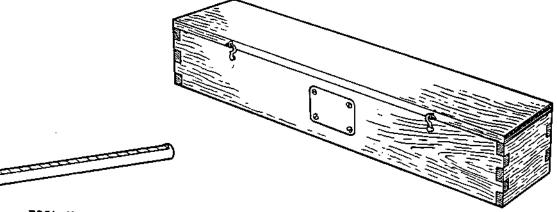
TOOL 754 10.00 X 6.25 X 2.50 IN (255 X 160 X 65 MM)



TOOL 15 26.00 X 5.00 X 4.25 IN (665 X 130 X 110 MM)



TOOL 267 29.25 X 7.00 X 5.75 IN (745 X 180 X 150 MM)



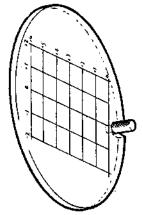
TOOL 11 13.25 X 1.75 X 1.50 IN (340 X 45 X 40 MM)

TOOL 169 14.75 X 2.75 X 2.75 IN (375 X 70 X 70 MM)

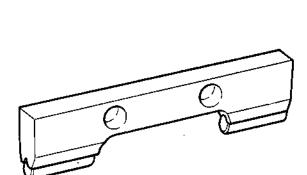
HP Turbine Rotor - Special Tools Figure 1004

SPECIAL TOOLS ETC.

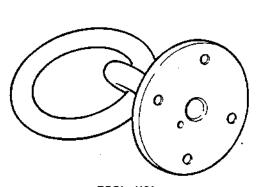
Page 1007 Dec 1/78



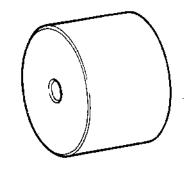
TOOL 33 1.90 X 6.50 IN DIA (38 X 170 MM)



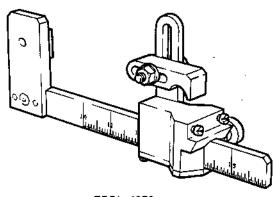
TOOL 1274 3.00 X 0.75 X 0.25 IN (80 X 20 X 10 MM)



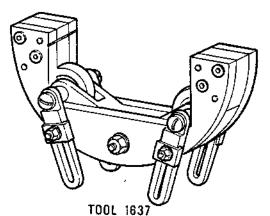
TOOL 1121 6.50 X 4.00 X 3.25 IN DIA (170 X 105 X 85 MM)



TOOL 27 0.75 X 4.00 IN DIA (20 X 105 MM)



TOOL 1272 9.00 X 3.75 X 2.00 IN (230 X 100 X 55 MM)



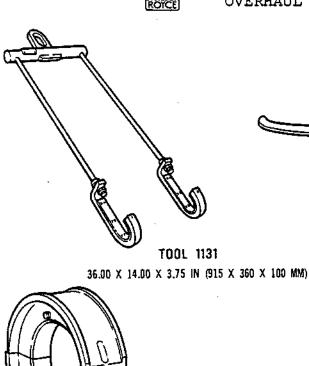
10.00 X 5.25 X 4.25 IN (255 X 135 X 110 MM)

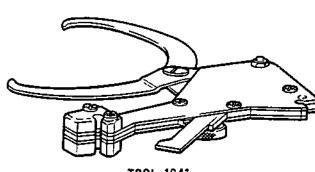
HP Turbine Rotor - Special Tools Figure 1005

SPECIAL TOOLS ETC.

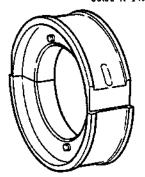
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CR 34785/00A

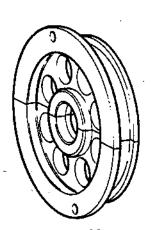




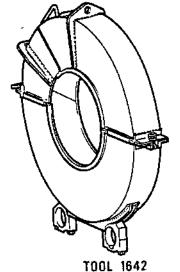
TOOL 1641 10.50 X 8.50 x 1.75 IN (270 X 220 X 45 MM)



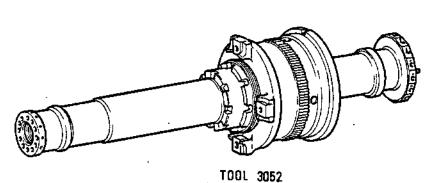
TOOL 1652 2.50 X 10.25 IN DIA (65 X 265 MM)



TOOL 363 1.50 X 8.00 IN DIA (40 X 205 MM)



55.75 X 54.00 X 10.50 IN (1420 X 1375 X 270 MM)

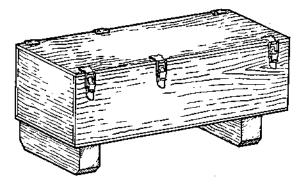


29.00 X 7.75 IN DIA (740 X 200 MM)

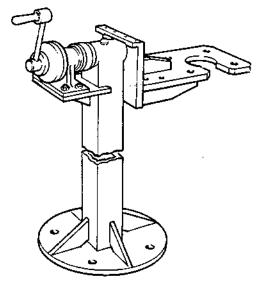
HP Turbine Rotor - Special Tools Figure 1006

SPECIAL TOOLS ETC.

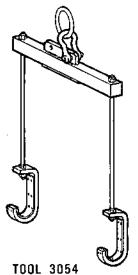
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TOOL 3066 32.00 X 14.75 X 14.00 IN (815 X 375 X 360 MM)

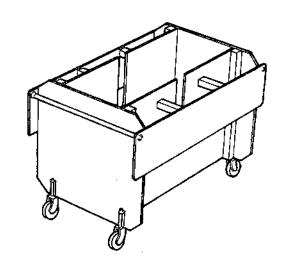


TOOL 3053 38.00 X 29.50 X 15.00 IN (970 X 750 X 385 MM)

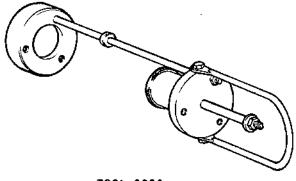


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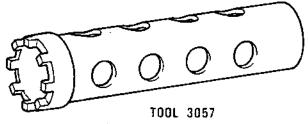
28.25 X 27.25 X 4.50 IN (720 X 695 X 115 MM)



TOOL 3055 54.25 X 36.00 X 34.50 IN (1380 X 915 X 880 MM)



TOOL 3056 36.00 X 6.25 IN RAD (915 X 160 MM)



16.75 X 4.00 IN DIA (430 X 105 MM)

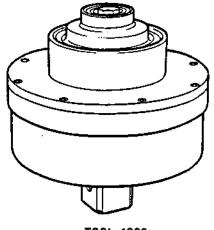
HP Turbine Rotor - Special Tools Figure 1007

SPECIAL TOOLS ETC.

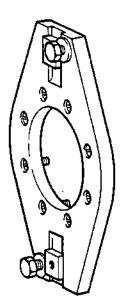
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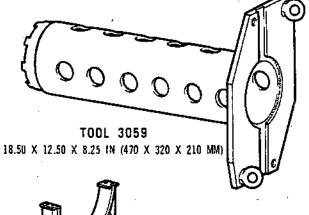




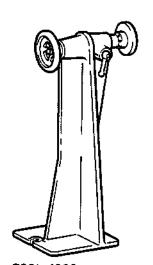
TOOL 1022 7.50 X 7.25 IN DIA (195 X 185 MM)



TOOL 3058 12.25 X 8.00 X 1.00 IN (315 X 205 X 30 MM)



TOOL 1073 30.50 X 15.00 X 9.50 IN (775 X 385 X 245 MM)

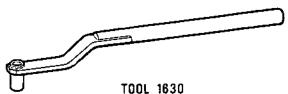


TOOL 1666 33,50 X 16.50 X 12.00 IN (855 X 420 X 305 MM)

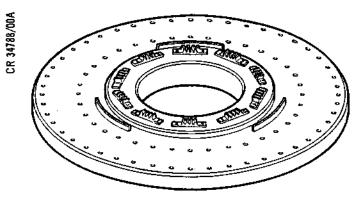
HP Turbine Rotor - Special Tools Figure 1008

SPECIAL TOOLS ETC.

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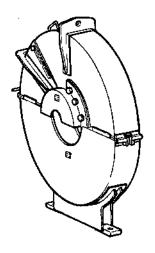
26.25 X 1.25 IN DIA (670 X 35 MM)



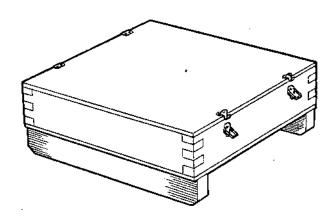
TOOL 1057 40.50 X 14.75 IN DIA (1030 X 375 MM)



TOOL 3067 3.00 X 29.50 IN DIA (80 X 750 MM)



TOOL 3068 57,00 X 56.00 X 14.00 IN (1450 X 1425 X 360 MM)



TOOL 3069 31.50 X 31.50 X 11.25 IN (805 X 805 X 290 MM)

HP Turbine Rotor - Special Tools Figure 1009

SPECIAL TOOLS ETC.

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LP TURBINE NOZZLE - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the LP turbine nozzle.
- B. The tools have been listed in order of usage and the Tool Ref. No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul, and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

LP Turbine Nozzle Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|-------------------------------|------|
| *1371 | POJ.1077501 | Container, vanes | 1001 |
| 962 | P3C.1234406 | Mechanical puller, cover unit | 1001 |
| *1417 | POJ.868930 | Container, diaphragm | 1001 |

Disassembly Tools Table 1001

3. LP Turbine Nozzle Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|------------------------------|------|
| 1321 | PJ.893232 | Guide sleeve, retaining ring | 1001 |
| 3071 | P3C.1263641 | Assembly tool, nozzles | 1001 |
| 1192 | PJ.858919 | Multiple leg sling, nozzle | |
| | | assembly | 1002 |

Sub-assembly Tools
Table 1002 (Continued)

SPECIAL TOOLS ETC.



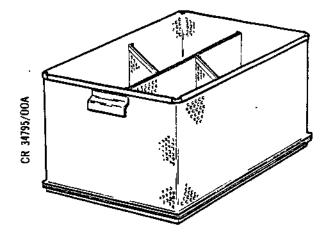
| TOOL REF.NO. | MANUFACTURERS PART NO. | DESCRIPTION | FIG. |
|--|--|---|--|
| 1645 1014 1935 1018 1262 1936 | T.251081 P3C.690045 PJ.1244786-90 PJ.1244791 P5G.865931 P5J.1264695 | Sling (1192) Pallet, CCOC Feeler gauges, vanes Container (1935) Clamping ring, vanes Station marking gauge, vanes | 1002 1002 1002 1002 1003 1003 |
| 1937 | T.367769) S3S.15217-000) S3S.15699000) | Dial indicator, vanes | 1003 |
| 1938 1939 1940 1941 | PG.893318 PG.893370 PG.893372 PG.893374 | Setting gauge (1937) Distance piece (1938) Distance piece (1938) Distance piece (1938) | 1003 1003 1003 1003 |
| 1942 | P5G.1264655) S3S.15698000) | Station guide (1937) | 1004 |
| 1943 | P5G.1264683) S3S.15701000) | Length gauge, vanes | 1004 |
| 1944 | P5G.1264690) S3S.15700000) | Setting block (1943) | 1004 |
| 1307 1008 *1371 *1417 | PJ.871924 PJ.1244706 POJ.1077501 POJ.868930 | Mobile table, nozzle assembly Setting tool, vanes Container, vanes Container, diaphragm | 1004 1004 1001 1001 |

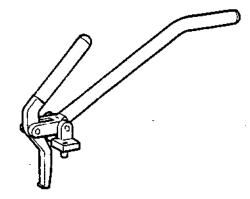
Sub-assembly Tools Table 1002 (Concluded)

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MK.610-14-28 OVERHAUL

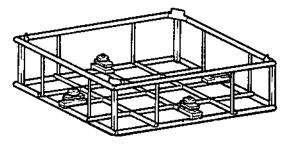




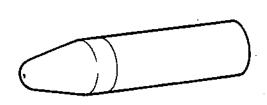


TOOL 962 12.75 X 3.00 X 2.50 IN (325 X 80 X 65 MM)

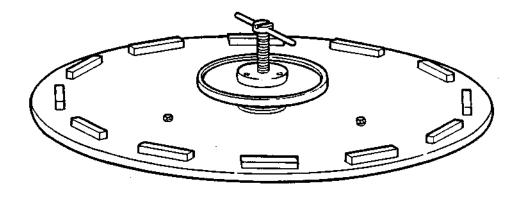
TOOL 1371 23.25 X 16.25 X 12.75 IN (595 X 415 X 325 MM)



TOOL 1417 28.00 X 28.00 X 6.50 IN (715 X 715 X 170 MM)



TOOL 1321 1.50 x 0.50 IN DIA (40 X 15 MM)



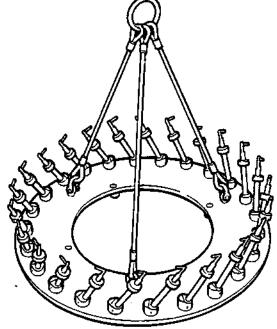
TOOL 3071 9.25 X 48.00 IN DIA (235 X 1220 MM)

LP Turbine Nozzle - Special Tools Figure 1001

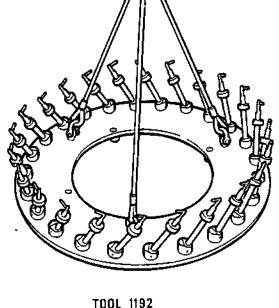
72-52-01 Page 1003 Dec 1/78

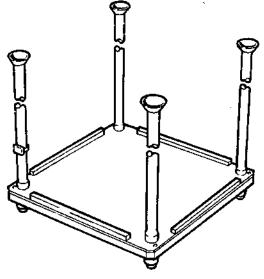




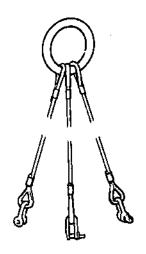


TOOL 1192 40.00 X 37.00 IN. DIA. (1020 X 940 MM)

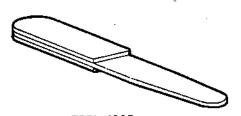




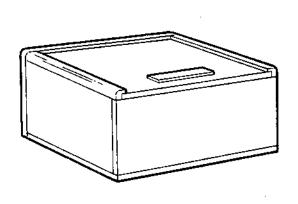
TOOL 1014 46.00 x 46.00 IN (1170 X 1170 MM) (HEIGHT AS REQUIRED)



TOOL 1645 36.00 X 47.00 IN, DIA.(915 X 1195 MM)



TOOL 1935 4.00 X 0.50 IN. (105 X 15 MM)



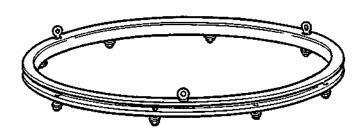
TOOL 1018 5.75 X 5.50 X 3.00 IN. (150 X 140 X 80 MM)

LP Turbine Nozzle - Special Tools Figure 1002

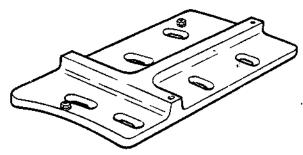
SPECIAL TOOLS ETC.

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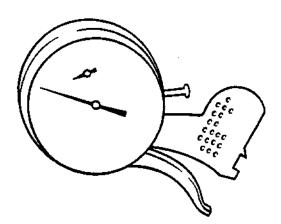
CR 34797/00A



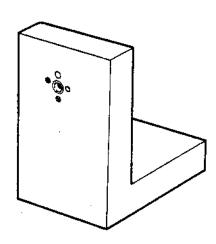
TOOL 1262 4.50 X 47.75 IN DIA (115 X 1215 MM)



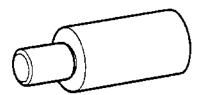
TOOL 1936 8.50 X 4.50 X 1.25 IN (220 X 115 X 35 MM)



TOOL 1937 3.75 X 1.00 IN (100 X 30 MM)



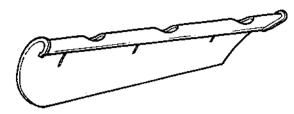
TOOL 1938 4.00 X 4.00 X 2.00 IN (105 X 105 X 55 MM)



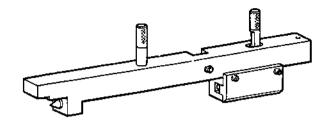
TOOL 1939 1.145 X 0.625 IN DIA (30 X 20 MM)
TOOL 1940 0.961 X 0.625 IN DIA (25 X 20 MM)
TOOL 1941 0.787 X 0.625 IN DIA (20 X 20 MM)

LP Turbine Nozzle - Special Tools Figure 1003

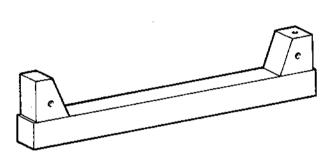
> 72-52-01 Page 1005 Dec 1/78



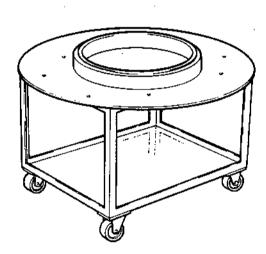
TOOL 1942 9.50 X 3.75 X 2.50 IN (245 X 100 X 65 MM)



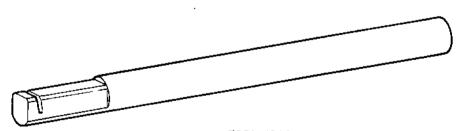
TOOL 1943 10.75 X 3.00 X 1.00 IN (275 X 80 X 30 MM)



TOOL 1944 11.25 X 2.50 X 1.00 IN (290 X 65 X 30 MM)



TOOL 1307 32.75 × 47.75 IN DIA (835 X 1215 MM)



TOOL 1008 21.00 X 1.50 IN DIA (535 X 40 MM)

LP Turbine Nozzle - Special Tools Figure 1004

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LP TURBINE ROTOR - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble/balance the LP turbine rotor.
- B. The tools have been listed in order of usage and the Tool Ref. No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text of the appropriate section.

2. LP Turbine Rotor Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|--|------|
| *1138 | P3C.850924 | Protector, turbine hub labyrinth | 1001 |
| *1134 | P3C.699980 | Protector, turbine labyrinth | 1001 |
| *I142 | P3C.850928 | Lifting fixture, turbine rotor | 1001 |
| 1670 | WJ.871050 | Support, turbine | 1001 |
| * 907 | PT.1234482 | Driver, turbine blades | 1001 |
| *1426 | POJ.868948 | Container, turbine blades | 1001 |
| * 873 | P3C.1263660 | Stand, turbine disk/hub | 1002 |
| 1140 | PJ.850926 | Clamping fixture (part of stand 873) | 1002 |
| *1141 | P3C.850927 | Lifting fixture, turbine rotor | 1002 |
| *1492 | P3C.1065978 | Socket wrench, disk bolts | 1002 |
| *1015 | P3C.1244710 | Mechanical puller, labyrinth housing from air tube | 1002 |
| *1137 | P3C.850923 | Mechanical puller, turbine bearing inner race | 1002 |

Disassembly Tools Table 1001

SPECIAL TOOLS ETC.



3. LP Turbine Rotor Assembly/Balancing Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|--------------|
| 950 | P3J.1229348 | Air nozzle, turbine blade cleaning | |
| *1426 | POJ.868948 | Container, turbine blades | 1001 |
| 16 | P3C.1072873 | Adapter, moment weighing blades vertical spindle machine | 1003 |
| 268 | P3C.1073061 | Container, adapter (16) | 1003 |
| 11 | P3C.1072868 | Adapter arm, moment weighing (16) | 1003 |
| 169 | PJ.1072874 | Container, adapter arm (11) | 1003 |
| 33 | PG.1223021 | Squared graticule, vectometer screen | 1003 |
| 28 | P3C.1073068 | Balance weight, adapter (16) | 1004 |
| 1274 | P3C.867008 | Adapter arm locater, adapter arm (1272) | 1004 |
| 1272 | P3C.867006 | Adapter arm, blade moment weighing, beam scales | 1004 |
| 1113 | P3C.699963 | Lifting fixture, balancing mandrel (1132) | 1004 |
| 1132 | PJ.699978 | Balancing mandrel (static), | |
| 1111 | P3C.699961 | turbine rotor Mobile stand, turbine rotor | 1004 1004 |
| 1121 | P3C.699965 | Lifting ring, balancing mandrel (1132) | 1004 |
| 1133 | P3C.699979 | Lifting fixture, turbine rotor | 1005 |
| 1012 | PJ.1246960 | Support, turbine disk and hub | 1005 |
| 1122 | P3C.699966 | Blading fixture, turbine disk | 1005 |
| 942 | P3C.1259739 | Retaining disk, blade locking tabs | |
| * 907 | PT.1234482 | Driver, turbine blades | 1001 |
| 1152 | PJ.1259734 | Blading base, blading fixture | |
| 954 | P3C.1229360 | (1122) Blade platform stand, blading fixture (1122) | 1005 |
| 1135 | P3C.699989 | Extension, balancing mandrel (1132) | 1006 |
| 1637 | T.225613 | Adjustable bearing, balancing machine | 1006 |
| 1131 | P3C.699975 | Lifting fixture, turbine rotor/ balancing mandrel | 1006 |
| 1641 | T.225614 | Setting gauge, adjustable bearing (1637) | 1006 |
| 1652 | T.443496 | Bearing housing, balancing machine | |

Assembly/Balancing Tools Table 1002 (Continued)

SPECIAL TCOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|------------------------------|---|------|
| 363 | PJ.1083233 | Slave bearing, bearing housing | |
| 3640 | m 500770 | (1652) | 1007 |
| 1642 | T.599772 | Shroud, protection, turbine rotor | |
| 1655 | T.484702 | Hammer, turbine blade locking tabs | 1007 |
| 1136 | P3C.850922 | Mechanical driver, turbine bearing (1136) | 1007 |
| 950 | P3C.1212110 | Slave bearing, LP turbine | 1007 |
| 850 * 873 | P3C.1212110 P3C.1263660 | Stand, turbine disk/hub | 1002 |
| 3072 | PJ.1244713 | Support wedges, 25/26 labyrinth | 1002 |
| 30 / 2 | PO.1244/13 | assembly | 1007 |
| 944 | PJ.1244712 | Sleeve support, support wedges | 100 |
| 944 | 10.1244/12 | (3072) | 1008 |
| 998 | P3C.1234582 | Lifting fixture, turbine rotor | 1001 |
| 1271 | PJ.866386 | Balancing mandrel (dynamic), | 1001 |
| 1271 | 10.000300 | turbine rotor | 100 |
| 1147 | PJ.850936 | Mobile stand, mandrel (1271) | 100 |
| 1143 | P3C.850930 | Lifting adapter, turbine/balancing | 100 |
| ±±33 | 130,030330 | mandrel (1271) | 100 |
| 1144 | P3C.850931 | Lifting adapter, turbine/balancing mandrel (1271) | 100 |
| *1141 | P3C.850927 | Lifting fixture, turbine rotor | 1002 |
| 1146 | P3C.850933 | Mechanical driver, turbine hub | 100 |
| 1596 | P3C.850934 | Hand spanner, turbine retaining | |
| • | | nut | 100 |
| 1243 | PJ.863603 | Immobiliser, wrench spanner (1580) | 100 |
| 1580 | PT.1234410 | Wrench spanner, turbine retaining | |
| | | nut | 100 |
| 1660 | P3C.523218 | Hand adapter, wrench spanner (1580) | 1009 |
| 1647 | T.279797 | Torque multiplier, wrench spanner (1580) | 100 |
| 1658 | T.520387 | Torque wrench, torque multiplier (1647) | 1010 |
| 1567 | PT.1229305 | Spanner, slip ring nut, mandrel (1271) | 1010 |
| 1258 | PJ.863798 | Shroud, mobile stand (1147) | 1010 |
| 1073 | P3C.695763 | Support, concentricity/swash check | 1010 |
| 966 | P3C.1234416) PJ.1255516) | Adjustable bearing, support (1073) (Alternative) | 1010 |

Assembly/Balancing Tools Table 1002 (Continued)

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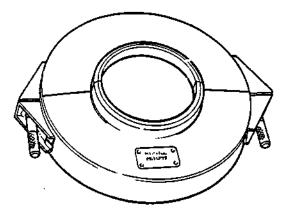
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| 1074 | P3C.695764 | Adapter, concentricity swash check | 1010 |
| 1650 | P3C.314328 | Bearing adapter, support (1074) | 1011 |
| 32 | P3C.1083365 | Setting gauge, adjustable bearing (966) | 1011 |
| 1145 | P3C.850932 | Lifting beam, turbine rotor/ | 1011 |
| 1638 | PT.251054 | Filler bush, hinged, balancing machine | 1011 |
| 1988 | P5W.1264661 | Guard, protection, belt | 1011 |
| 1303 | P3C.869283 | Shroud, protection, turbine rotor | 1011 |
| 1291 | PJ.867097 | Support brackets, shroud (1303) | 1012 |
| 109 | P3C.1062953 | Support brackets, restraining bars | 1012 |
| *1142 | P3C.850928 | Lifting/extracting fixture, turbine rotor | 1001 |
| *1015 | PJ.1244710 | Mechanical puller, No.25 and 26 | |
| *1137 | P3C.850923 | labyrinth Mechanical puller, turbine | 1002 |
| +1400 | Dm 1065070 | bearing inner race | 1002 |
| *1492 | PT.1065978 | Socket wrench, disk bolts | 1002 |
| 34 | PG.1244715 | Base block, dial indicator | 1012 |
| 1156 | P3C.850957 | Checking fixture, dimensional check | 1012 |
| *1134 | P3C.699980 | Protector, turbine labyrinth | 1001 |
| *1138 | P3C.850924 | Protector, turbine hub labyrinth | 1001 |

Assembly/Balancing Tools Table 1002 (Concluded)

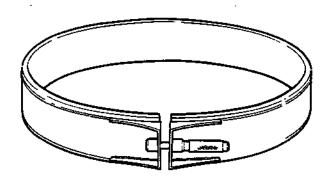
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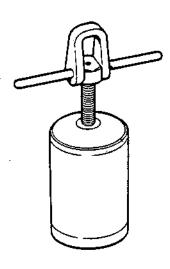
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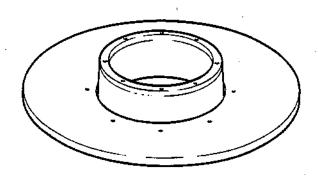
TOOL 1138 14.00 X 2.75 IN (360 X 70 MM)



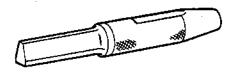
TOOL 1134 13.75 X 2.25 X 13.00 IN DIA (350 X 60 X 335 MM)



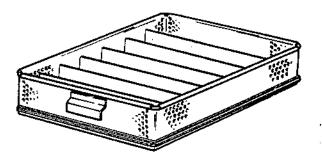
TOOL 1142 11.00 X 16.75 IN (280 X 430 MM)



TOOL 1670 4.75 X 47.50 IN DIA (125 X 1210 MM)



TOOL 907 8.25 X 1.00 IN DIA (210 X 30 MM)

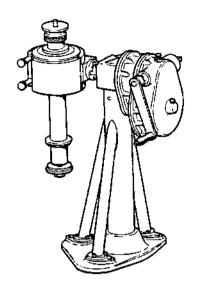


T00L 1426 23.00 X 15.75 X 3.75 IN (585 X 405 X 100 MM)

LP Turbine Rotor - Special Tools Figure 1001

SPECIAL TOOLS ETC.

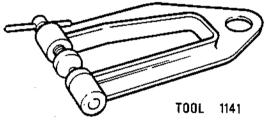
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TOOL 873 40,50 X 25.50 X 20.00 IN (1030 X 650 X 510 MM)

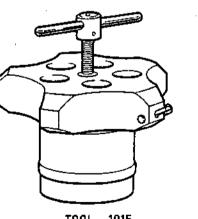


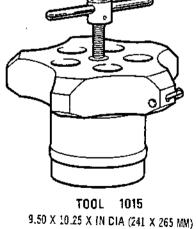
TOOL 1140 39.50 X 7.75 IN DIA (1005 X 200 MM)

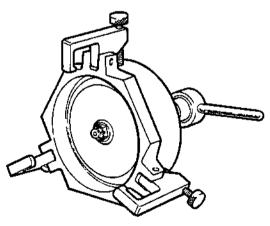


25.25 X 13.75 X 2.50 IN (645 X 350 X 65 MM)





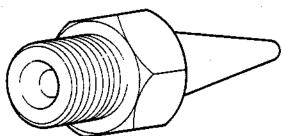




TOOL 1137 8,75 X 8,25 X 7.75 IN (225 X 210 X 200 MM)

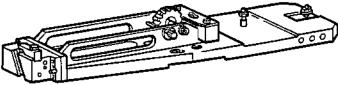
SPECIAL TOOLS ETC.

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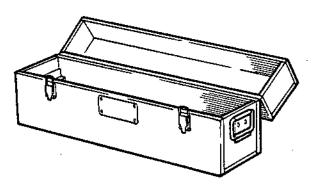


34822/00

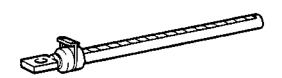
TOOL 950 1.25 X 0.50 IN DIA (35 X 15 MM)



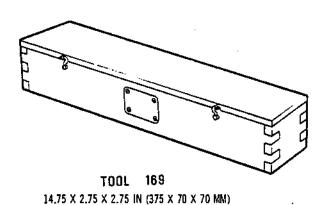
TOOL 16 20.50 X 5.00 X 4.00 IN (525 X 130 X 105 MM)

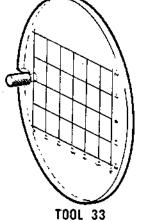


TOOL 268 23.75 X 7.00 X 6.25 IN (605 X 180 X 160 MM)



TOOL 11 - 13.25 X 1.75 X 1.50 IN (340 X 45 X 40 MM)

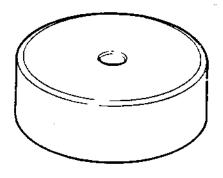




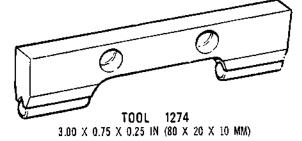
1.00 X 6.50 IN DIA (30 X 170 MM)

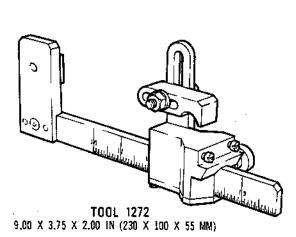
SPECIAL TOOLS ETC.

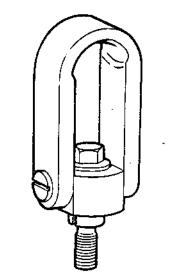
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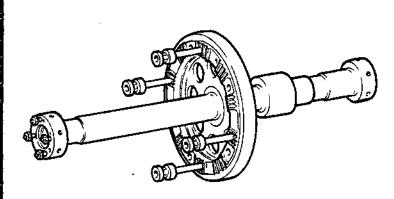
TOOL 28 1.50 X 4.00 IN DIA (40 X 105 MM)



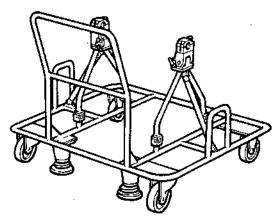




TOOL 1113 5.50 X 2.75 X 1.75 IN DIA (140 X 70 X 45 MM)



TOOL 1132 31.00 X 11.75 IN DIA (790 X 300 MM)

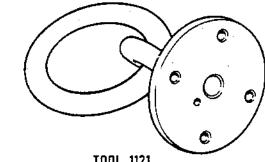


TOOL 1111 52.50 X 45.25 X 44.00 IN (1335 X 1150 X 1120 MM)

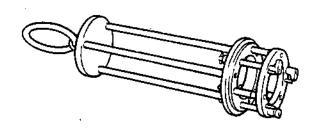
SPECIAL TOOLS ETC.

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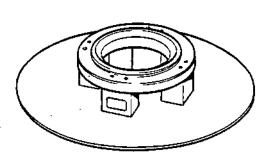
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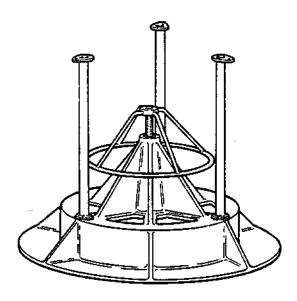
TOOL 1121 6.50 X 4.00 X 3.25 IN DIA (170 X 105 X 85 MM)



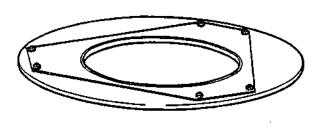
TOOL 1133 24.25 X 5.75 IN DIA (620 X 150 MM)



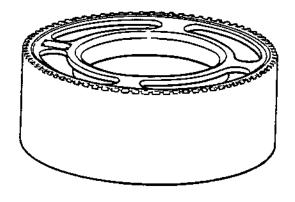
TOOL 1012 4.50 X 22.00 IN DIA (115 X 560 MM)



TOOL 1122 37.75 X 48.00 IN.DIA (960 X 1220 MM)



TOOL 942 1.00 X 20.00 IN DIA (30 X 510 MM)



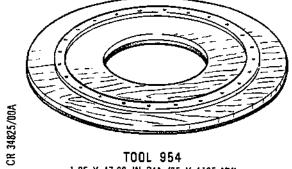
TOOL 1152 8.00 X 21.50 IN DIA (205 X 550 MM)

LP Turbine Rotor - Special Tools Figure 1005

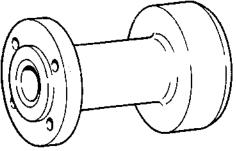
SPECIAL TOOLS ETC.

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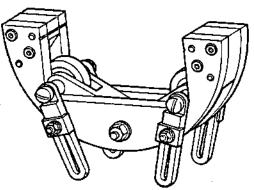
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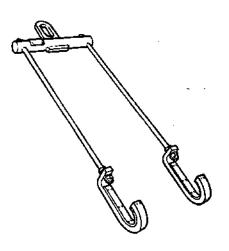
TOOL 954 1.25 X 47.00 IN DIA (35 X 1195 MM)



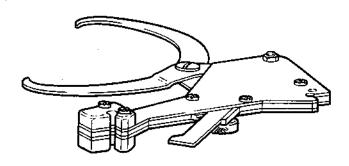
TOOL 1135 5.25 X 3.25 IN DIA (135 X 85 MM)



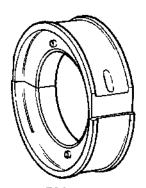
TOOL 1637 10.00 X 5.25 X 4.25 IN (255 X 135 X 110 MM)



TOOL 1131 36.00 X 14.00 X 3.75 IN (915 X 360 X 100 MM)



TOOL 1641 10.50 X 8.50 X 1.75 IN (270 X 220 X 45 MM)



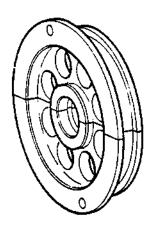
TOOL 1652 2.50 X 10.25 IN DIA (65 X 265 MM)

SPECIAL TOOLS ETC.

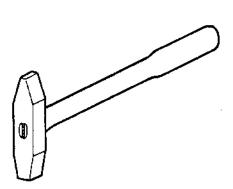
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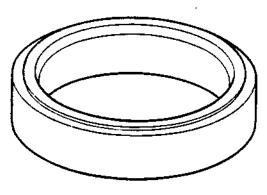




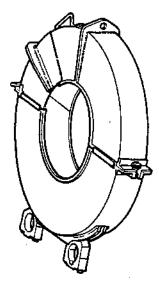
TOOL 363 1,50 X 8.00 IN DIA (40 X 205 MM)



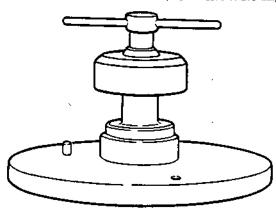
TOOL 1655 12.00. X 4.25 X 1.00 IN (305 X 110 X 30 MM)



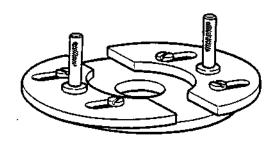
TOOL 850 1.50 X 6.25 IN DIA (40 X 150 MM)



TOOL 1642 55.75 X 54.00 X 10.50 IN (1420 X 1375 X 270 MM)

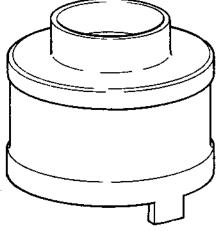


TOOL 1136 16.00 X 13.75 IN (410 X 350 MM)



TOOL 3072 2.50 X 4.75 IN DIA (65 X 125 MM)

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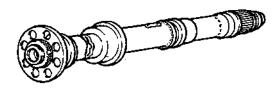


TOOL 944 4.25 X 4.75 IN DIA (110 X 125 MM)

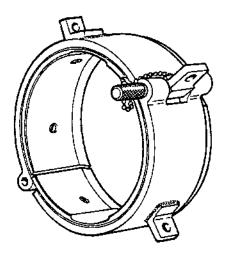


TOOL 998 55.25 X 45.00 X 22.75 IN (1405 X 1145 X 580 MM)

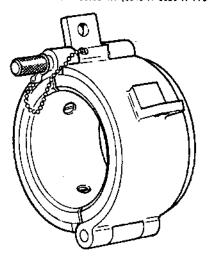
TOOL 1147 72.50 X 40.50 X 30.50 IN (1845 X 1030 X 775 MM)



TOOL 1271 83.75 X 11.00 IN DIA (2130 X 280 MM)



TOOL 1143 I2.00 X 12.00 X 5.75 IN (305 X 305 X 150 MM)



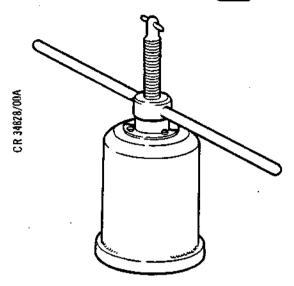
TOOL 1144 9.25 X 9.25 X 5.75 IN (235 X 235 X 150 MM)

LP Turbine Rotor - Special Tools Figure 1008

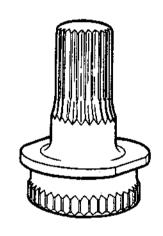
SPECIAL TOOLS ETC.

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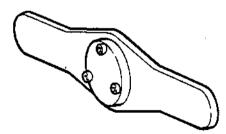
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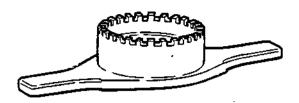
TOOL 1146 25.00 X 15.25 X 5.25 IN DIA (635 X 390 X 135 MM)



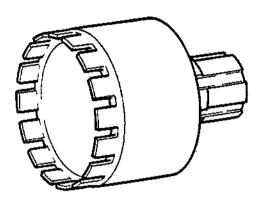
TOOL 1243 4.75 X 3.25 IN DIA (125 X 85 MM)



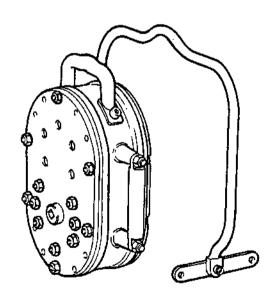
TOOL 1660 18.00 X 4.00 X 1.00 IN (460 X 105 X 30 MM)



TOOL 1596 16.00 X 2.75 X 6.25 IN DIA (410 X 70 X 160 MM)

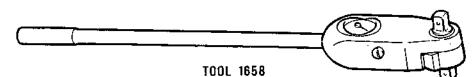


TOOL 1580 5.75 X -5.25 IN DIA (150 X 135 MM)



TOOL 1647 14.50 X 14.50 X 6.50 IN DIA (370 X 370 X 170 MM)

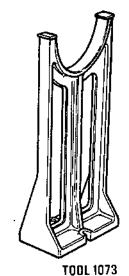
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29.00 X 4.50 X 3.00 IN (740 X 115 X 77 MM)

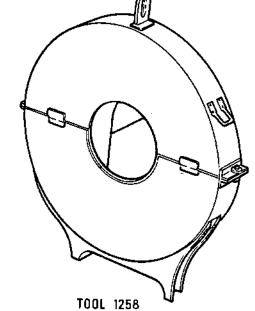


TOOL 1567 18.00 X 5.00 X 0.25 IN (460 X 130 X 10 MM)

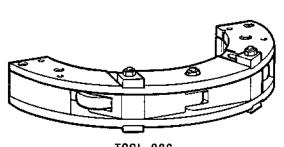


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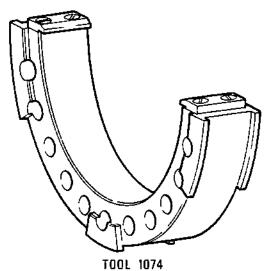
30.50 X 15.00 X 9.50 IN (775 X 385 X 245 MM)



51.25 X 51.00 X 16.75 INS (1305 X 1300 X 430 MM)



TOOL 966 3.00 X 13.00 IN DIA (80 X 335 MM)

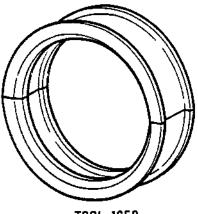


13.50 X 7.00 X 2.50 IN (345 X 180 X 55 MM)

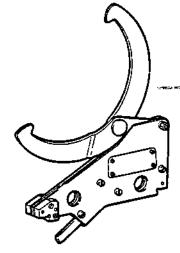
LP Turbine Rotor - Special Tools Figure 1010

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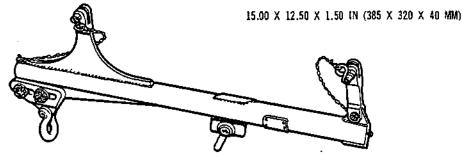
CR 34830/00A



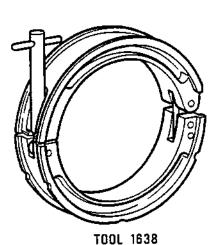
TOOL 1650 2.50 X 8.25 IN OIA (65 X 210 MM)



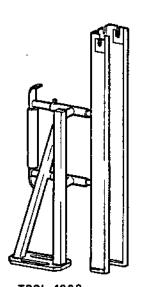
TOOL 32



TOOL 1145 37.75 X 17.00 X 4.00 IN (960 X 435 X 105 MM)



11.25 X 11.00 X 2.50 IN (285 X 280 X 65 MM)



TOOL 1988 34.75 X 15.25 X 8.25 IN (885 X 390 X 210 MM)

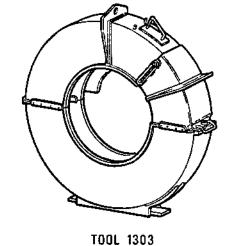
LP Turbine Rotor - Special Tools Figure 1011

SPECIAL TOOLS ETC.

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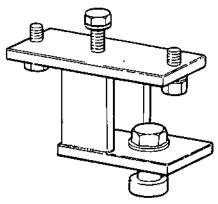
Page 1015 Dec 1/78

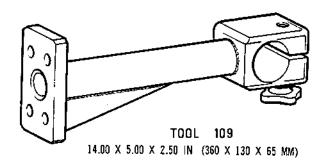


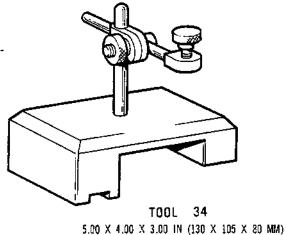


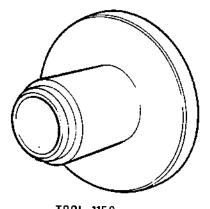
53.50 X 51.50 X 16.50 IN (1360 X 1310 X 420 MM)

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TOOL 1156 8.00 X 12.50 X IN DIA (205 X 320 MM)

LP Turbine Rotor - Special Tools Figure 1012

SPECIAL TOOLS ETC.

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LP TURBINE BEARING SUPPORT - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the LP turbine bearing support.
- B. The tools have been listed in order of usage and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of the overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. LP Turbine Bearing Support, Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| *1256 | PJ.863678 | Support plate, bearing housing | |
| | | assembly | 1001 |
| 1584 | P3C.1234429 | Wrench ring cranked, rear cover | 1001 |
| * 847 | P3C.1094869 | Holding fixture, rear cover | 1001 |
| 455 | PJ.1266404 | Mechanical puller, air feed socket | 1001 |
| 449 | PJ.1266403 | Adapter, mechanical puller | |
| | | (455, 448 and 447) | 1001 |
| 448 | PJ.1266405 | Mechanical puller, vent socket | 1001 |
| 447 | PJ.1266406 | Mechanical puller, seal housing | 1002 |
| 1250 | P3C.863669 | Mechanical puller, cover assembly | 1002 |
| 1251 | P3C.863670 | Mechanical puller, sleeve assembly | 1002 |
| 1964 | P3C.1244630 | Mechanical puller, sleeve assembly | 1002 |
| 1252 | P3C.863671 | Mechanical puller, outer labyrinth housing | 1002 |
| 1982 | PJ.1073084 | Pliers, bearing rollers | 1003 |

Disassembly Tools Table 1001

SPECIAL TOOLS ETC.

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3. L.P. Turbine Bearing Support Assembly Tools

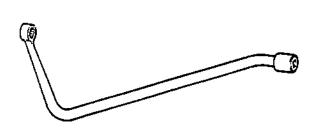
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| 412 | P3C.1083370 | Locating fixture, bearing housing | 1003 |
| 971 | P3C.1234437 | Protector, bearing housing oil feed boss | 1003 |
| 446 | P3C.1086794 | Positioning fixture, sleeve and cover | 1003 |
| *1256 | PJ.863678 | Support plate, bearing housing | 1001 |
| 445 | P3C.1086793 | Locating pin, sleeve/cover to bearing housing | 1003 |
| * 847 | P3C.1094869 | Holding fixture, rear cover | 1001 |

Assembly Tools Table 1002

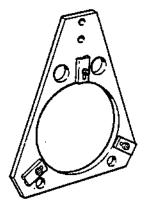
TN8337

CR 34840/00A

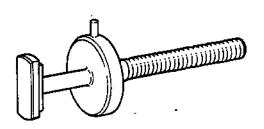
TOOL 1256 5.25 X 17.25 IN DIA (135 X 440 MM)



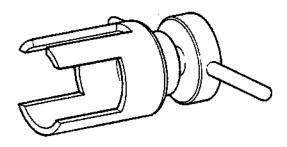
TOOL 1584 10.00 X 3.25 X 0.75 IN (255 X 85 X 20 MM)



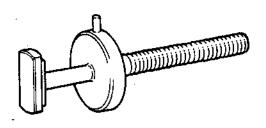
TOOL 847 14.25 X 12.00 X 1.75 IN (365 X 305 X 45 MM)



TOOL 455 6.00 X 2.50 X 2.00 IN (155 X 65 X 55 MM)



TOOL 449 8.50 X 4.75 X 3.00 IN (220 X 125 X 80 MM)



TOOL 448 6.00 x 2.50 x 2.00 in (155 x 65 x 55 mm)

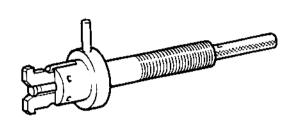
LP Turbine Bearing Support - Special Tools Figure 1001

> 72-52-03 Page 1003 Dec 1/78

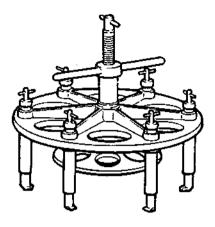


MK.610-14-28 OVERHAUL

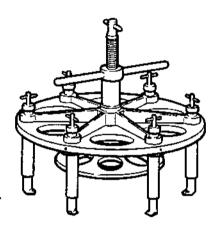




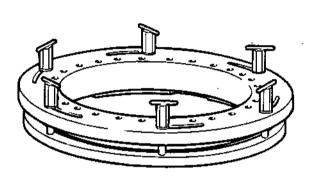
TOOL 447 6.75 X 1.50 IN DIA (175 X 40 MM)



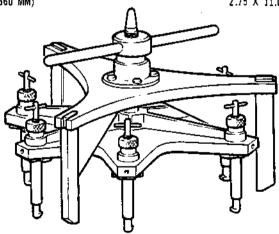
TOOL 1250 11.00 X 15.25 IN DIA (280 X 390 MM)



TOOL 1251 13.75 X 14.00 IN DIA (350 X 360 MM)



TOOL 1964 2.75 X 11.00 IN DIA (70 X 280 MM)



TOOL 1252 9.25 x 13.25 IN DIA (235 X 340 MM)

LP Turbine Bearing Support - Special Tools Figure 1002

SPECIAL TOOLS ETC.

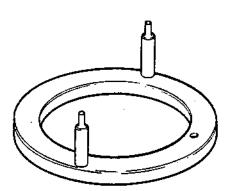
Page 1004 Dec 1/78



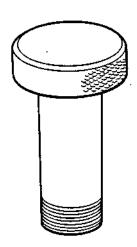


CR 34842/00A

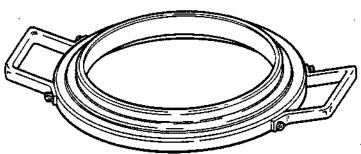
TOOL 1982 7.50 X 2.50 X 1.00 IN (190 X 65 X 30 MM)



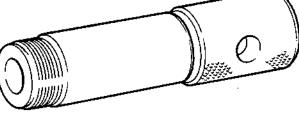
TOOL 412 4.25 X 10.50 IN DIA (110 X 270 MM)



TOOL 971 2.75 X 1.50 IN DIA (70 X 40 MM)



TOOL 446 17.00 X 1.50 X 12.50 IN DIA (435 X 40 X 320 MM)



TOOL 445 4.00 X 1.00 IN DIA (105 X 30 MM)

LP Turbine Bearing Support - Special Tools Figure 1003

SPECIAL TOOLS ETC.

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TURBINE EXHAUST DIFFUSER - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the LP turbine exhaust diffuser.
- B. The tools have been listed in order of usage, and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. Turbine Exhaust Diffuser Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| * 309 | PJ.1073144 | Mounting plate (Part of 832), turbine exhaust diffuser | 1001 |
| * 832 | P3C.1262695 | Stand, turbine exhaust diffuser | 1001 |
| * 437 | P3C.1086733 | Protector, rear of turbine exhaust diffuser | 1001 |
| * 305 | P3C.1073197 | Lifting fixture, diffuser inner case | 1001 |
| *1953 | P5J.1299711 | Lifting fixture, diffuser inner case | 1001 |
| *1963 | P5J.1220403 | Spring compressor, PNC pitot | 1001 |
| *1965 | P5J.1212152 | Lifting fixture, spherical joint flange | 1002 |
| *1325 | PJ.869238 | Protector, signal system cable end | 1002 |
| * 906 | P3C.1223005 | Open end wrench, oil scavenge tube | 1002 |
| * 872 | P3C.1094827 | Torque wrench, oil scavenge tube | 1002 |
| * 625 | P3C.1255575 | Torque wrench, cold air vent tube | 1002 |
| * 626 | P3C.1255574 | Torque wrench, cold air vent tube | 1002 |
| * 846 | P3C.1094858 | Holder, oil feed and cold vent tube | 1003 |
| *1047 | P3C.1255586 | Torque wrench, oil feed tube | 1003 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| *1046 | P3C.1255585 | Torque wrench, oil feed tube | 1003 |
| 1992 | PT.871674 | Crank ring wrench, seal housing | 1003 |
| *1584 | P3C.1234429 | Cranked ring wrench, rear cover | 1003 |
| 413 | P3C.1083371 | Lifting fixture, turbine bearing support | 1003 |
| 420 | P3C.1083372 | Support, lifting fixture (413) | 1004 |
| * 299 | P3C.1073166 | Jacking fixture (Part of 832), turbine inner case | 1001 |
| * 811 | P3C.1089482 | Mobile stand, jacking fixture (299) | 1004 |
| 1690 | P3C.473508 | Impact puller, hollow pins | 1004 |
| * 298 | P3C.1073165 | Lifting fixture, diffuser outer case | 1004 |
| *1966 | P5J.1297567 | Lifting handles, containment shield | 1004 |

Disassembly Tools Table 1001 (Concluded)

3. Turbine Exhaust Diffuser Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| * 309 | PJ.1073144 | Mounting plate (Part of 832), turbine exhaust diffuser | 1001 |
| * 832 | P3C.1262695 | Stand, turbine exhaust diffuser | 1001 |
| * 299 | PJ.1073166 | Jacking fixture (Part of 832), turbine inner case | 1001 |
| * 811 | P3C.1089482 | Mobile stand, jacking fixture (299) | 1004 |
| * 305 | P3C.1073197 | Lifting fixture, diffuser inner case | 1001 |
| *1953 | P3C.1299711 | Lifting fixture, diffuser inner case | 1001 |
| * 298 | P3C.1073165 | Lifting fixture, diffuser outer case | 1004 |

Assembly Tools
Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| *1966 | P5J.1297567 | Lifting handles, containment shield | 1004 |
| 297 | P3C.1073153 | Support bracket, slave, con- tainment shield | 1005 |
| 300 | P3C.1073167 | Locating pins, inner to outer case | 1005 |
| 1049 | PJ.1255588 | Nut runner, oil feed and cold vent tube | 1005 |
| * 846 | P3C.1094858 | Holder, oil feed and cold vent tube | 1003 |
| 871 | P3C.1094855 | Adapter, wrench (1046), torque setting | 1005 |
| *1046 | P3C.1255585 | Torque wrench, oil feed tube | 1003 |
| *1047 | P3C.1255586 | Torque wrench, oil feed tube | 1003 |
| 1957 | P5J.1288006 | Adapter, centralizing, cold vent tube | 1005 |
| * 625 | P3C.1255575 | Torque wrench, cold air vent tube | 1002 |
| * 626 | P3C,1255574 | Torque wrench, cold air vent tube | 1002 |
| *1584 | P3C.1234429 | Cranked ring wrench, rear cover | 1003 |
| 322 | P3C.1073276 | Adapter wrench (872), torque setting | 1005 |
| * 872 | P3C.1094827 | Torque wrench, oil scavenge tube | 1002 |
| * 906 | P3C.1223005 | Open end wrench, oil scavenge tube | 1002 |
| 1926 | S3S.10753000 | Test rig, mobile, oil pressure | 1006 |
| 703 | PJ.1089283 or | Adapter, oil pressure test, | 1006 |
| | S3S.11349000 | oil tubes | |
| 295 | P3C.1073146 | Blank, oil pressure test, bearing housing | 1006 |
| 1958 | P5J.1259730 | Blank, oil pressure test, bearing housing | 1006 |
| 296 | P3C.1073147 | Support, pressure test blank (295, 1958) | 1006 |
| 1534 | PJ.1089480 | Crowfoot wrench, adapter (703) | 1006 |
| *1325 | PJ,869238 | Protector, signal system cable end | 1002 |
| *1965 | P5J.1212152 | Lifting fixture, spherical joint flange | 1002 |
| 700 | P3C.1089276 | Locating pin, spherical joint flange/outer case | 1007 |
| *1963 | P5J.1220403 | Spring compressor, PNC pitot | 1001 |
| | | | |

Assembly Tools Table 1002 (Continued)

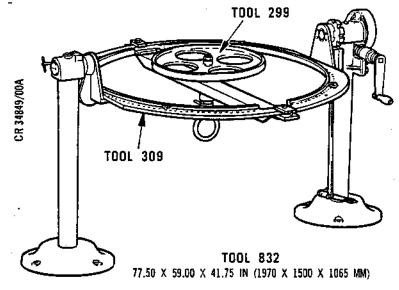
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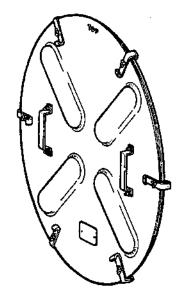
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---|------|
| 1968 | P5J.1288057 | Tapered guide, PNC pitot circlip | 1007 |
| 1967 | P5J.1288056 | Punch, PNC pitot circlip | 1007 |
| 961 | PJ.1224405 | Protector, fuel drain | 1007 |
| 1230 | PJ.861896 | Platform, support, exhaust diffuser | 1007 |
| 1428 | POJ.868956 | Pallet | 1007 |
| * 437 | PJ.1086733 | Protector, rear of turbine exhaust diffuser | 1001 |

Assembly Tools Table 1002 (Concluded)

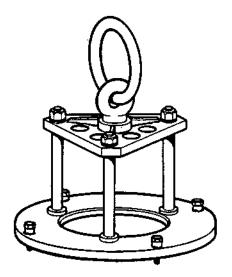
TN33835



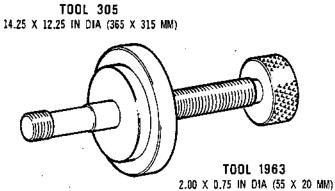


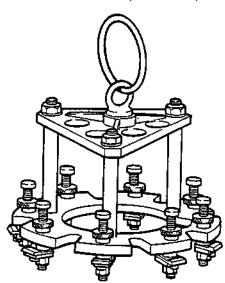


TOOL 437 3.00 X 42.00 IN DIA (80 X 1070 MM)



TOOL 305



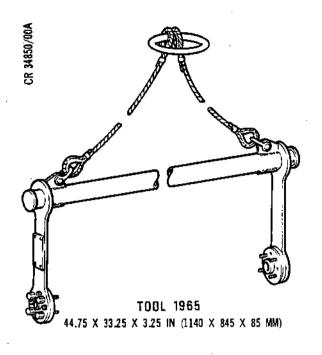


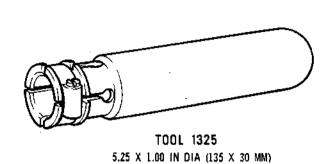
TOOL 1953 10.50 X 12.50 IN DIA (270 X 320 MM)

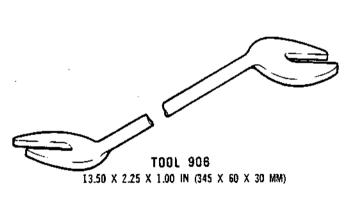
SPECIAL TOOLS ETC.

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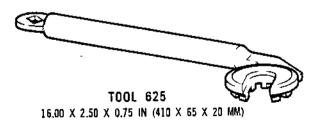


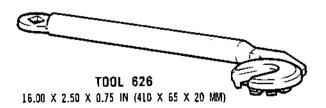






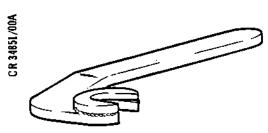
TOOL 872 9.50 X 3.75 X 3.50 IN (245 X 100 X 90 MM)



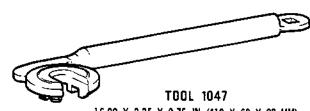


SPECIAL TOOLS ETC.

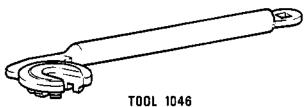
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TOOL 846 12.75 X 2.75 X 0.75 IN (325 X 70 X 20 MM)



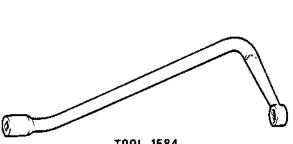
16.00 X 2.25 X 0.75 IN (410 X 60 X 20 MM)

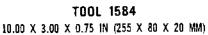


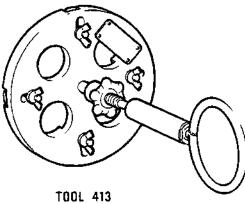
16.00 X 2.25 X 0.75 IN (410 X 60 X 20 MM)



TOOL 1992 7.75 X 1.50 X 0.50 IN (200 X 40 X 15 MM)







16.50 X 8.00 IN DIA (420 X 205 MM)

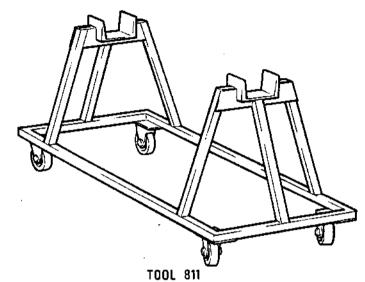
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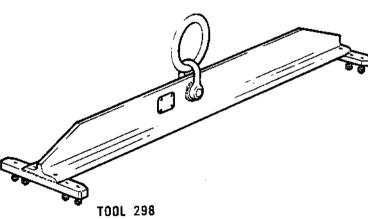
TOOL 420

12.75 X 3.25 X 1.25 MM (325 X 85 X 35 MM)



TOOL 1690 3.50 X 1.00 IN (90 X 30 MM)

60.00 X 25.50 X 24.00 IN (1525 X 650 X 610 MM)



42.50 X 9.75 X 7.50 IN (1080 X 250 X 195 MM)



TOOL 1966 4.00 X 0.75 IN DIA (105 X 20 MM)

Turbine Exhaust Diffuser - Special Tools Figure 1004

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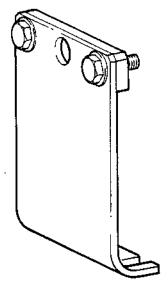
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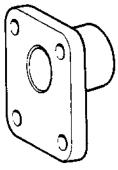




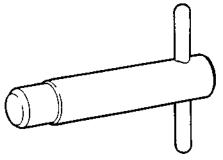
TOOL 297 4.00 X 3.00 X 1.25 IN (105 X 80 X 35 MM)



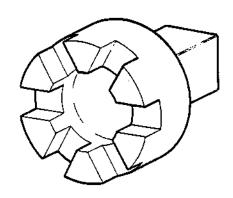
TOOL 1049 0.50 X 1.75 IN DIA (15 X 45 MM)



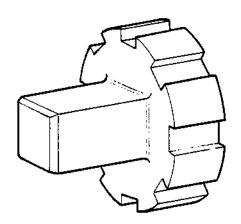
TOOL 1957 2.50 X 2.25 X 1.25 IN (65 X 60 X 35 MM)



TOOL 300 3.75 X 2.75 X 0.75 IN (100 X 70 X 20 MM)



TOOL 871 1.75 X 1.00 IN DIA (45 X 30 MM)



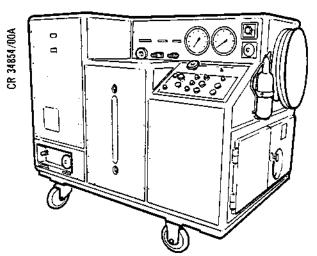
TOOL 322 1.25 X 1.25 IN DIA (35 X 35 MM)

Turbine Exhaust Diffuser - Special Tools Figure 1005

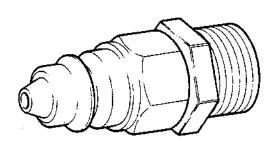
SPECIAL TOOLS ETC.

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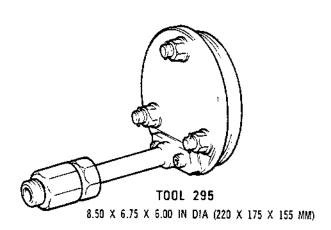


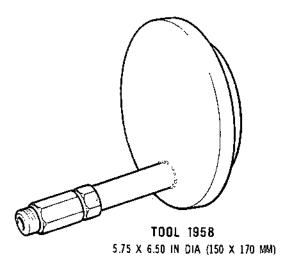


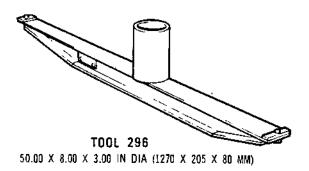
TOOL 1926 71.00 X 57.00 X 45.00 IN (1805 X 1450 X 1145 MM)

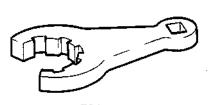


TOOL 703 3.25 X 1.50 IN DIA (85 X 40 MM)









TOOL 1534 4.00 X 2.50 X 0.50 IN (105 X 65 X 15 MM)

SPECIAL TOOLS ETC.

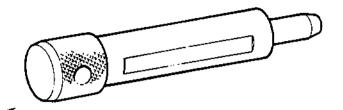
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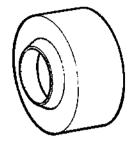


MK.610-14-28 OVERHAUL

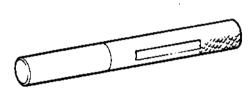




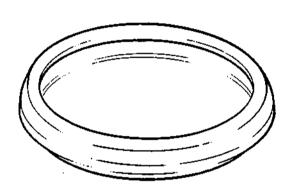
質 TOOL 700 2.75 X 0.50 IN DIA (70 X 15 MM)



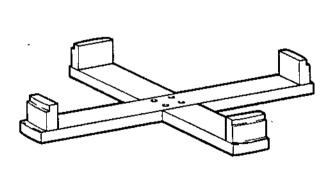
TOOL 1968 0.75 X 1.60 IN DIA (20 X 30 MM)



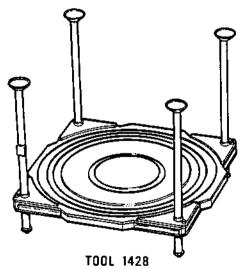
TOOL 1967 4.00 X 0.50 IN DIA (105 X 15 MM)



TOOL 961 0.75 X 7.50 IN DIA (20 X 195 MM)



TOOL 1230 3.00 X 48.25 IN DIA (80 X 1230 MM)



48.50 X 48.50 X 38.50 IN (1235 X 1235 X 980 MM)

Turbine Exhaust Diffuser - Special Tools Figure 1007

SPECIAL TOOLS ETC.

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LEFT-HAND ACCESSORY GEARBOX - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the left-hand gearbox.
- B. The tools have been listed in order of usage, and the Tool Ref.No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul, and will be duplicated in the tables.
- C. The tools have been illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as though necessary), are included in the text in the appropriate section.

Left-hand Gearbox Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|-----------------------------|------|
| * 875 | P3C.1212206 | Assembly stand, gearbox | 1001 |
| * 285 | P3C.1073107 | Lifting fixture, gearbox | 1001 |
| * 867 | P3C.1212204 | Adapter, gearbox main drive | |
| | | location (875) | 1001 |
| 1159 | P3C.852048 | Container, pulse probe | 1001 |
| 200 | P3C.1065894 | Protector, gearbox, pulse | |
| | | probe location | 1001 |
| * 279 | PJ.1073119 | Container, protectors | 1001 |
| * 93 | P3C.1050094 | Lifting fixture, oil pump | 1002 |
| 1668 | T.914825 | Puller, oil pump cover | 1002 |
| 931 | P3C.1229291 | Protector, oil pump | 1002 |
| 1632 | P3C.6590 | Container, oil pump | 1002 |
| 121 | P3C.1063669 | Protector, oil pump | 1002 |
| 141 | PJ.1065026 | Protector, gearbox location | 1002 |
| * 146 | P3C.1065802 | Protector, QAD coupling | |
| | | location | 1003 |
| 145 | P3C.1065801 | Protector, front cover | 1003 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| 715 *1021 * 140 * 177 * 191 * 192 | P3C.1089308 P3C.624598 P3C.1065025 P3C.1065845 P3C.1065874 P3C.1065877 PJ.861895 | Mechanical puller, flanged pins Puller, front cover Protector, gearbox/front cover joint Puller, diaphragm pins Protector, bearing | 1003 1003 1003 1003 |
|--|--|--|------------------------------|
| *1021 * 140 * 177 * 191 * 192 | P3C.624598 P3C.1065025 P3C.1065845 P3C.1065874 P3C.1065877 | <pre>pins Puller, front cover Protector, gearbox/front cover joint Puller, diaphragm pins</pre> | 1003 |
| * 140 * 177 * 191 * 192 | P3C.1065025 P3C.1065845 P3C.1065874 P3C.1065877 | Puller, front cover Protector, gearbox/front cover joint Puller, diaphragm pins | 1003 |
| * 140 * 177 * 191 * 192 | P3C.1065025 P3C.1065845 P3C.1065874 P3C.1065877 | Protector, gearbox/front cover joint Puller, diaphragm pins | |
| * 177 * 191 * 192 | P3C.1065845 P3C.1065874 P3C.1065877 | cover joint Puller, diaphragm pins | |
| * 191 * 192 | P3C.1065874 P3C.1065877 | Puller, diaphragm pins | 1003 |
| * 191 * 192 | P3C.1065874 P3C.1065877 | | |
| * 192 | P3C.1065877 | | 1004 |
| | | Protector, bearing | 1004 |
| *1229 | e a = 00 107 3 | Tray, gearshafts | 1004 |
| * 152 | P3C.1065809 | Holding fixture, diaphragm | 1004 |
| *1643 | S3S.10246000 | Hydraclamp, holding fixture | |
| ~ 1043 | 0500240000 | (152) | 1004 |
| * 166 | P3C.1065837 | Vice holder, gearshaft | 1004 |
| *1511 | P3C.1073193 | Wrench spanner, bearing | |
| - 1711 | 130:10/31/3 | retaining nut | 1005 |
| * 167 | P30.1065839 | Vice holder, gearshaft | 1005 |
| *1487 | P3C.1065838 | Wrench spanner, bearing | |
| * 1407 | F30.1003030 | locknut | 1005 |
| 223 | P3C.1065935 | Mechanical puller, bearing | 1009 |
| 196 | P3C.1065887 | Support, quillshaft | 1005 |
| 195 | P3C.1065886 | Driver, oil feed sleeve | 1005 |
| 273 | P3C.1073098 | Mechanical puller, oil trap | 1006 |
| | P3C.1065849 | Vice holder, gearshaft | 1006 |
| * 178 | P3C.1065850 | Wrench spanner, bearing | |
| *1490 | P3C.1083830 | locknut | 100 |
| . 4 5 / / | P3C.1223197 | Wrench spanner, bearing | 1000 |
| *1 566 | P3C.1223197 | locknut | 1006 |
| 225 | P3C.1065938 | Mechanical puller, bearing | 100 |
| 225 | P3C.1003938 | (Pre.SB.72-9023-403) | |
| 7450 | \$35.20213000 | Mechanical extractor | 103 |
| 3150 | 535.20213000 | (SB.72-9023-403) | 103 |
| . 207 | P3C.1073187 | Vice holder, gearshaft | 100 |
| * 303 | | | 100 |
| *1491 | P3C.1065857 | Wrench spanner, bearing locknut | 100 |
| .4500 | P3C.1073190 | | 100 |
| *1509 | P3C.1073190 | Wrench spanner, bearing | 100 |
| 220 | D76 10450/4 | locknut Mechanical puller, gearshaft | 100 |
| 229 | P3C.1065946 | | 100 |
| * 304 | P3C.1073189 | Vice holder, gearshaft | 100 |
| 224 | P3C.1065937 | Mechanical puller, bearing Immobilizer, bevel pinion | 100 |
| * 331 | P3C.1076035 | Immobilizer, bevel pinion Immobilizer plate, bevel | 100 |
| * 332 | P3C.1076036 | pinion | 100 |

Disassembly Tools Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|----------------------------|--|------|
| * 800 | PJ.1264696 | Support plate (1486) | 1008 |
| *1486 | P3C.1065833 | Wrench spanner, bevel | |
| | | pinion retaining nut | 1008 |
| 213 | P3C.1065917 | Mechanical puller, bevel | |
| * 168 | P3C.1065841 | pinion | 1008 |
| 100 | 230.1003041 | Immobilizer, spiral bevel pinion | 1000 |
| *1558 | P3C.1223058 | Wrench spanner, spiral | 1008 |
| | | bevel gear | 1008 |
| * 220 | P3C.1065931 | Mechanical driver, spiral | |
| | | bevel pinion | 1009 |
| * 154 | P3C.1065811 | Puller, hollow pins | 1009 |
| *1653 | P3C.473505 | Impact puller, (154) (155) | |
| + 156 | D20 1065015 | (156) | 1009 |
| * 156 * 155 | P3C.1065815 P3C.1065813 | Puller, oil strainer | 1009 |
| 142 | P3C.1065027 | Puller, oil strainer | 1009 |
| 172 | F3C.1005027 | Protector, gearbox strainer location | 1009 |
| 204 | PJ.1065896 | Protector, rear cover, | 1009 |
| | | qearbox | 1010 |
| 198 | P3C.1065892 | Protector, gearbox | 1010 |
| * 313 | P3C.1073285 | Lifting fixture, gearbox | 1010 |
| * 199 | P3C.1065893 | Protector, gearbox main drive location | 1010 |
| * 151 | P3C.1065808 | Holding fixture, front | 1010 |
| | | cover | 1011 |
| * 158 | P3C.1065820 | Puller, oil filter | 1011 |
| * 159 | P3C.1065822 | Vice holder, oil filter | 1011 |
| *1484 | P3C.1065821 | Driver, oil cap, plug and filter | 1011 |
| *1485 | P3C.1065823 | Turning key, oil filter | 1011 |

Disassembly Tools Table 1001 (Concluded)

SPECIAL TOOLS ETC.

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3. Left-hand Gearbox Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|--|------|
| | PART NO. | DESCRIPTION | NO. |
| * 151 | P3C.1065808 | Holding fixture, front cover | 1011 |
| *1643 | S3S.10246000 | Hydraclamp, holding fixture (152) | 1004 |
| 1524 | P3C.1086799 | Driver, stepped pins | 1012 |
| * 146 | PJ.1065802 | Protector, QAD coupling location | 1003 |
| 272 | P3C.1073096 | Mechanical puller, flanged pin | 1012 |
| 269 | P3C.1073090 | Nut (272) | 1012 |
| *1484 | P3C.1065821 | Driver, oil cap, plug and filter | 1012 |
| * 159 | P3C.1065822 | Vice holder, oil filter | 1011 |
| *1485 | P3C.1065823 | Turning key, oil filter | 1011 |
| * 140 | PJ.1065025 | Protector, gearbox/front cover joint | 1001 |
| 153 | P5T.1288059 | Driver, hollow pins | 1012 |
| * 156 | P3C.1065815 | Puller, oil strainer | 1009 |
| * 875 | P3C.1212206 | Assembly stand, gearbox | 1001 |
| * 867 | P3C.1212204 | Adapter, gearbox main drive location (875) | 1001 |
| 868 | P3C.1212205 | Adapter, pressure test (875) | 1012 |
| * 313 | P3C.1073285 | Lifting fixture, gearbox | 1010 |
| 1481 | P3C.1065812 | Driver, oil strainer | 1013 |
| 271 | \$35.10736000 | Guide sleeve, retaining rings | |
| 1959 | \$35,10737000 | Driver (271) | 1013 |
| 1926 | S3S.10753000 | Test rig, mobile, oil | |
| 704 | P3C.1089284 | pressure Adapter, pressure test, front | 1013 |
| | | cover | 1013 |
| 799 | P3C.1212175 | Container, oil pressure test equipment | 1013 |
| 149 | P3C.1065805 | Adapter, pressure test, oil pump location | 1013 |
| 150 | P3C.1065806 | Blank, pressure test, gearbox case | 1014 |
| 797 | P3C.1089446 | Protection cover, gearbox | 1014 |
| *1021 | P3C.624598 | Puller, front cover | 1003 |
| | | | |

Sub-Assembly Tools Table 1002 (Continued)

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|---|------|
| | | | |
| * 158 | P3C.1065820 | Puller, oil filter | 1011 |
| * 1 77 | P3C.1065845 | Puller, diaphragm pins | 1003 |
| * 154 | P3C.1065811 | Puller, hollow pins | 1009 |
| *1653 | P3C.437505 | Impact puller, (154) (155) (156) | 1009 |
| * 155 | P3C.1065813 | Puller, oil strainer | 1009 |
| * 152 | P30.1065809 | Holding fixture, diaphragm (1643) | 1004 |
| 160 | P3C.1065826 | Container, setting gauges (6) (7) | 1014 |
| 161 | P3C.1065829 | Container, setting gauges (8) (9) | 1014 |
| 7 | P3C.1065825 | Setting gauge, oil pump | 1014 |
| 8 | P3C.1065827 | bevel pinion Setting gauge, main drive | 1014 |
| | | spiral bevel pinion | 1015 |
| 3144 | \$3\$20076000 | Setting gauge, main drive spiral bevel pinion | 1023 |
| 6 | P3C.1065824 | Setting gauge, oil pump bevel gear | 1015 |
| 9 | P3C.1065828 | Setting gauge, main drive bevel gear | 1015 |
| 162 | P3C.1065830 | Support, bevel pinion roller bearing | 1015 |
| 1510 | P3C.1073192 | Driver (162) | 1015 |
| 164 | P3C.1065832 | Draw screw, bearing | 1015 |
| 163 | P3C.1065831 | Mechanical puller (164) | 1016 |
| * 331 | P3C.1076035 | Immobilizer, bevel pinion | 1007 |
| * 332 | P3C.1076036 | Immobilizer plate, bevel pinion | 1008 |
| * 800 | PJ.1264696 | Support plate, (1486) (1656) | 1008 |
| *1486 | P3C.1065833 | Wrench spanner, bevel pinion retaining nut | 1008 |
| 1656 | P3C.512900 | Torque wrench, spanner | 1016 |
| 175 | P3C.1065843 | Support, spiral bevel pinion roller bearing | 1016 |
| 1489 | P3C.1065842 | Driver, bearing inner track | 1016 |
| 176 | P3C.1065844 | Mechanical puller (1489) | 1016 |
| * 168 | P3C.1065841 | Immobilizer, spiral bevel | • |
| | | pinion | 1008 |

Sub-Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL | MANUFACTURER | • | |
|---------------|--------------|------------------------------|------|
| REF.NO. | PART NO. | DESCRIPTION | NO. |
| *1558 | P3C.1223058 | Wrench spanner, sprial bevel | |
| | | gear | 1008 |
| 10 | P3C.1065945 | Checking gauge, bevel pinion | 1016 |
| 307 | P3C.1073204 | Draw screw | 1017 |
| 306 | P3C.1073203 | Mechanical puller (307) | 1017 |
| * 167 | P3C.1065839 | Vice holder, gearshaft | 1005 |
| *1487 | P3C.1065838 | Wrench spanner, bearing | |
| | | locknut | 1005 |
| 1648 | т.295037 | Torque wrench | 1017 |
| 165 | P3C.1065835 | Draw screw, gearshaft | 1017 |
| 203 | P3C.1065836 | Mechanical puller (165) | 1017 |
| * 166 | P3C.1065837 | Vice holder, gearshaft | 1004 |
| *1511 | P3C.1073193 | Wrench spanner, bearing | |
| | | retaining nut | 1009 |
| 180 | P3C.1065852 | Draw screw, bearing | 1017 |
| 185 | P3C.1065859 | Mechanical puller (180) | 1018 |
| * 303 | P3C.1073187 | Vice holder, gearshaft | 1006 |
| * 1509 | P3C.1073190 | Wrench spanner, bearing | |
| | | locknut | 1007 |
| 179 | P3C.1065851 | Mechanical puller, gearshaft | |
| | | (180) | 1018 |
| *1491 | P3C.1065857 | Wrench spanner, bearing | |
| | | locknut | 100 |
| 189 | P3C.1065871 | Immobilizer, gearshaft | 1018 |
| 188 | P3C.1065870 | Immobilizer, gearshaft | 1018 |
| 190 | P3C.1065872 | Indicating fixture, backlash | 1018 |
| 953 | PJ.1234491 | Indicating fixture, backlash | 1018 |
| 3145 | s3s20053000 | Gear loading kit | 1023 |
| 182 | P3C.1065854 | Draw screw, bearing | 1019 |
| 181 | P3C.1065853 | Mechanical puller (182) | 101 |
| * 178 | P3C.1065849 | Vice holder, gearshaft | 100 |
| *1566 | P3C.1223197 | Wrench spanner, bearing | |
| | | locknut | 100 |
| * 1490 | P3C.1065850 | Wrench spanner, bearing | |
| | | locknut | 100 |
| * 304 | P3C.1073189 | Vice holder, gearshaft | 100 |
| 184 | P3C.1065858 | Draw screw, bearing | 1019 |
| * 191 | P3C.1065874 | Protector, bearing | 1004 |
| * 192 | P3C.1065877 | Protector, bearing | 1004 |

Sub-Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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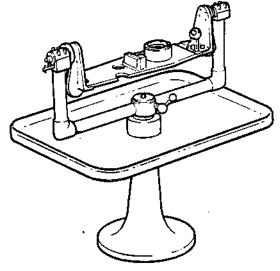
| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|-----------------------|---------------------------|------|
| *1229 | PJ.861895 | Tray, gearshafts | 1004 |
| 911 | P3C.1223046 | Indicating fixture, | |
| | | backlash | 1019 |
| 912 | P3C.1223047 | Immobilizer, gearshaft | 1019 |
| 1505 | P3C.1073097 | Driver, oil trap sleeve | 1019 |
| 194 | P3C.1065885 | Support, quillshaft | 1020 |
| 193 | P3C.1065884 | Driver, oil feed sleeve | 1020 |
| 222 | P3C.1065934 | Protector, QAD coupling | |
| | | location | 1020 |
| 1664 | P3C.530647 | Torque wrench | 1020 |
| * 93 | P3C.1050094 | Lifting fixture, oil pump | 1002 |
| 705 | P3C.1263667 | Adapter blank, pressure | |
| | | test | 1020 |
| 218 | P3C.1065925 | Blank, pressure test | 1020 |
| 219 | P3C.1065926 | Blank, pressure test | 102 |
| 217 | P3C.1065923 | Blank, pressure test | 1021 |
| 281 | P3C.1073103 | Blank, pressure test | 1021 |
| 650 | P3C.1262655 | Blank, pressure test | 102 |
| 915 | P3C.1223065 | Adapter, drain valve, | |
| | | pressure test | 1021 |
| 86 | P3C.1050024 | Bolt, slave (915) | 1021 |
| * 220 | P3C.1065931 | Mechanical driver, spiral | |
| | | bevel pinion | 1009 |
| * 279 | PJ.1073119 | Container, protectors | 1001 |
| 124 | P3C.1063672 | Protector, oil pump | 1022 |
| 122 | P3C.1063670 | Protector, oil pump | 1022 |
| 123 | P3C.1063671 | Protector, oil pump | 1022 |
| 120 | P3C.1063668 | Protector, oil pump | 1022 |
| 282 | P3C.1073104 | Protector, oil pump | 102 |
| 201 | P3C.1065895 | Protector, gearbox | 1022 |
| * 199 | P3C.1065893 | Protector, gearbox main | |
| | | drive location | 1010 |
| * 285 | P3C.1073107 | Lifting fixture, gearbox | 1001 |
| 1911 | 1702113 | Tri-wing bit | 1022 |
| 1912 | 1701234 | Tri-wing bit holder | 1022 |

Sub-Assembly Tools Table 1002 (Concluded)

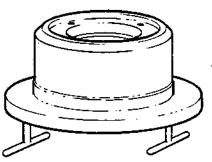
SPECIAL TOOLS ETC.

72-62-00

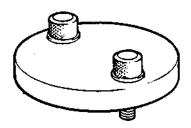
Page 1007 Nov 1/78



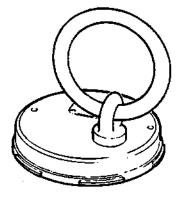
TOOL 875 71.00 X 48.00 X 42.00 IN (1805 X 1220 X 1070 MM)



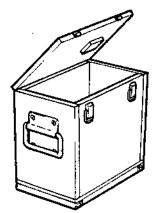
TOOL 867 6.00 X 9.00 IN DIA (155 X 230 MM)



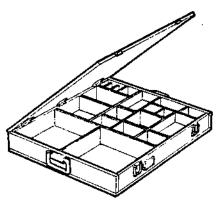
TOOL 200 1.50 X 3.50 IN DIA (40 X 90 MM)



TOOL 285 7.75 X 7.25 X 6.50 IN (200 X 185 X 170 MM)



TOOL 1159 7.25 X 6.50 X 4.75 IN (185 X 170 X 125 MM)

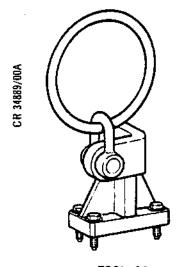


TOOL 279 21.25 X 17.00 X 2.75 IN (540 X 435 X 70 MM)

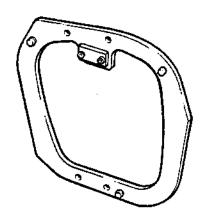
Left-hand Accessory Gearbox - Special Tools Figure 1001

SPECIAL TOOLS ETC.

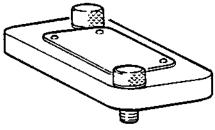
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TOOL 93 6.75 X 6.75 X 3.75 IN (175 X 175 X 190 MM)



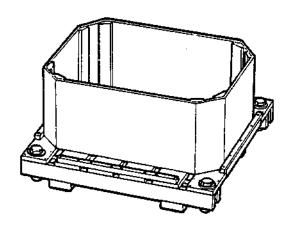
TOOL 931 11.75 X 11.50 X 1.25 IN (300 X 295 X 35 MM)



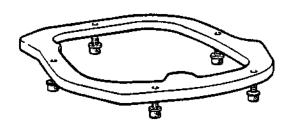
TOOL 121 3.75 X 2.00 X 1.25 IN (100 X 55 X 35 MM)



TOOL 1868 5.75 X 2.75 X 0.25 IN DIA (150 X 70 X 10 MM)



TOOL 1632 45.25 X 45.00 X 24.50 IN (1150 X 1145 X 625 MM)

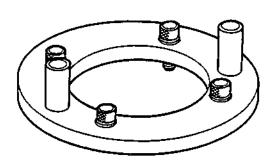


TOOL 141 12.00 X 11.50 X 1.75 IN (305 X 295 X 45 MM)

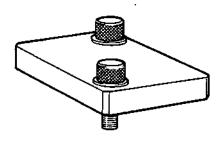
Left-hand Accessory Gearbox - Special Tools Figure 1002

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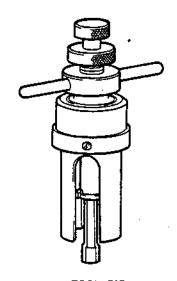




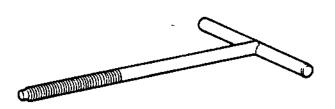
TOOL 146 2.25 X 6.50 IN DIA (60 X 170 MM)



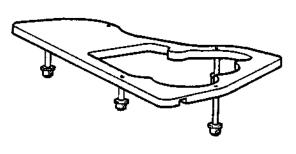
TOOL 145 2.00 X 2.00 X 1.25 IN (55 X 55 X 35 MM)



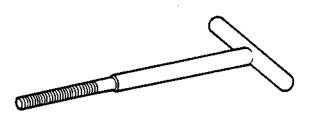
TOOL 715 5.50 X 3.75 X 1.75 IN (140 X 100 X 45 MM)



TOOL 1021 6.00 X 3.75 X 0.25 IN DIA (155 X 100 X 10 MM)



TOOL 140 17.25 X 11.00 X 3.25 IN (440 X 280 X 85 MM)



TOOL 177 4.75 X 2.75 X 0.25 IN D/A (125 X 70 X 10 MM)

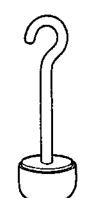
Left-hand Accessory Gearbox - Special Tools Figure 1003

SPECIAL TOOLS ETC.

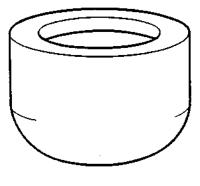
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MK.610-14-28 OVERHAUL

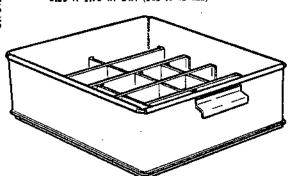




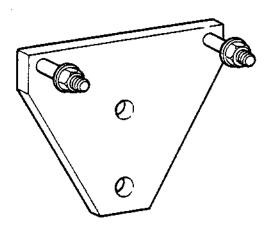
質 TOOL 191 6.25 X 1.75 IN DIA (160 X 45 MM)



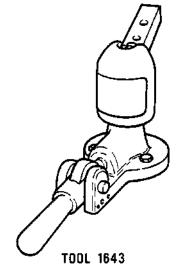
TOOL 192 1.50 X 1.75 IN DIA (40 X 45 MM)



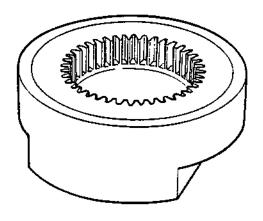
TOOL 1229 23.00 X 15.75 X 6.00 IN (585 X 405 X 155 MM)



TOOL 152 4.50 X 3.50 X 1.50 IN (E15 X 90 X 40 MM)



10.00 X 7.00 X 4.00 IN DIA (255 X 180 X 105 MM)



TOOL 166 2.00 X 5.00 IN DIA (55 X 130 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1004

SPECIAL TOOLS ETC.

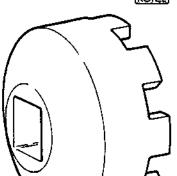
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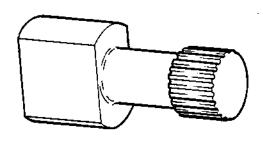


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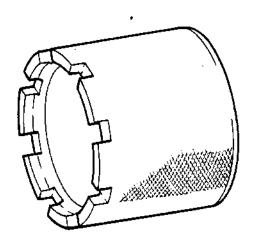




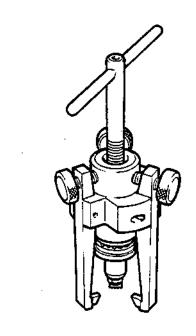
TOOL 1511 1.00 X 2.00 IN DIA (30 X 55 MM)



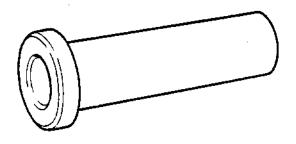
TOOL 167 2.75 X 1.25 IN DIA (70 X 35 MM)



TOOL 1487 1.50 X 1.50 IN DIA (40 X 40 MM)



TOOL 223 6.75 X 4.50 X 2.75 IN (175 X 115 X 70 MM)



TOOL 196 5.50 X 2.00 (N DIA (140 X 55 MM)



TOOL 195 9.25 X 0.75 IN DIA (235 X 20 MM)

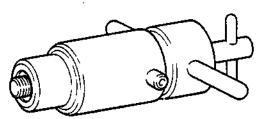
Left-hand Accessory Gearbox - Special Tools Figure 1005

SPECIAL TOOLS ETC.

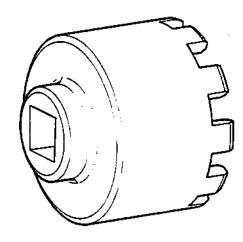
72-62-00

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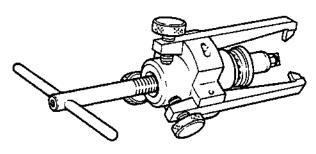




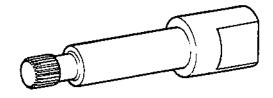
TOOL 273 4.50 X 4.25 X 1.25 IN (115 X 110 X 35MM)



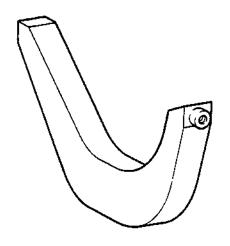
TOOL 1490 1.75 X 2.00 IN DIA (45 X 55 MM)



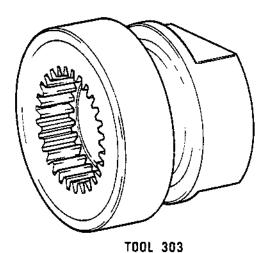
TOOL 225 6.75 X 4.50 X 2.75 IN (175 X 115 X 70 MM)



TOOL 178 6.50 X 1.50 IN DIA (170 X 40 MM)



TOOL 1566 8.25 X 4.00 X 0.75 IN (210 X 105 X 20 MM)

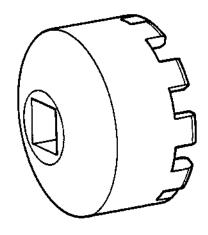


3.25 X 4.25 IN DIA (85 X 110 MM)

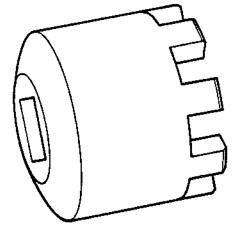
Left-hand Accessory Gearbox - Special Tools Figure 1006

SPECIAL TOOLS ETC.

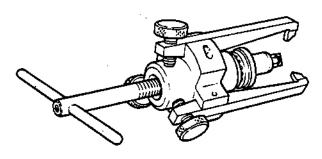
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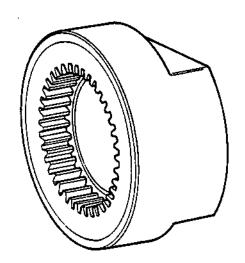
TOOL 1491 1.25 X 2.00 IN OIA (35 X 55 MM)



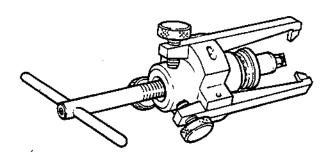
TOOL 1509 1.25 X 1.25 IN DIA (35 X 35 MM)



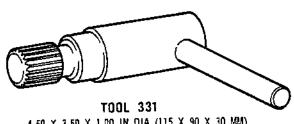
TOOL 229 6.75 X 4.50 X 2.75 IN (175 X 115 X 70 MM)



TOOL 304 2.50 x 5.00 IN DIA (65 X 130 MM)



TOOL 224 6.75 X 4.50 X 2.50 IN (175 X 115 X 65 MM)

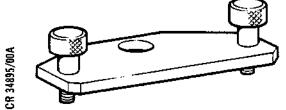


4.50 X 3.50 X 1.00 IN DIA (115 X 90 X 30 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1007

SPECIAL TOOLS ETC.

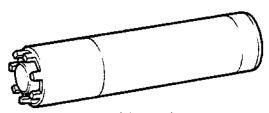
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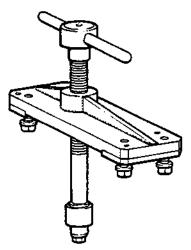
TOOL 332 5,00 x 1.75 x 1.50 IN (130 X 45 X 40 MM)



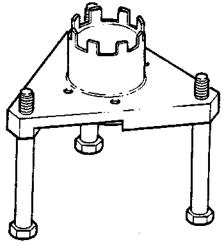
TOOL 800 10.75 X 3.25 X 1.50 IN (275 X 85 X 40 MM)



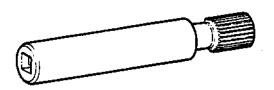
TOOL 1486 6.25 X 1.50 IN DIA (160 X 40 MM)



TOOL 213
10.75 X 9.75 X 3.00 IN (275 X 250 X 80 MM)



TOOL 168 4.75 X 4.75 X 4.00 IN (125 X 125 X 105 MM)

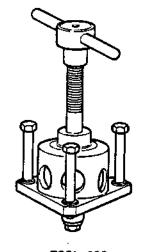


TOOL 1558 6.50 X 1.00 IN DIA (170 X 30 MM)

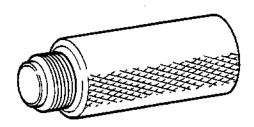
Left-hand Accessory Gearbox - Special Tools Figure 1008

SPECIAL TOOLS ETC.

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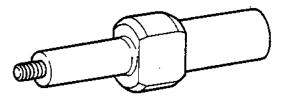
TOOL 220 8.50 X 8.00 X 3.50 IN (220 X 205 X 90 MM)



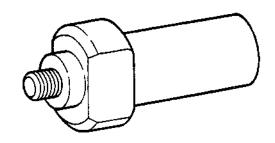
TOOL 154 2.00 X 0.75 IN DIA (55 X 20 MM)



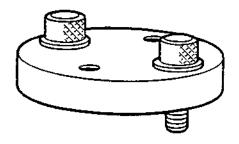
TOOL 1653 10.50 X 0.25 IN DIA (270 X 10 MM)



TOOL 156 2.75 X 0.75 IN DIA (70 X 20 MM)



TOOL 155 1.75 X 0.75 IN DIA (45 X 20 MM)

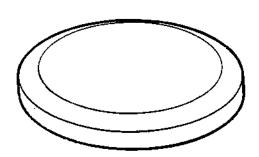


TOOL 142 1.25 X 2.50 IN DIA (35 X 65 MM)

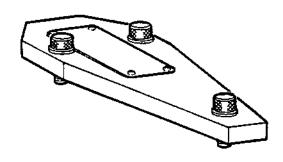
Left-hand Accessory Gearbox - Special Tools Figure 1009

SPECIAL TOOLS ETC.

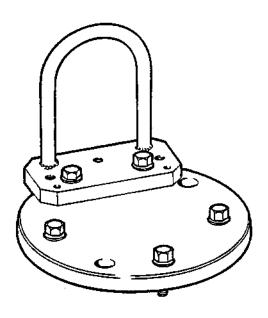
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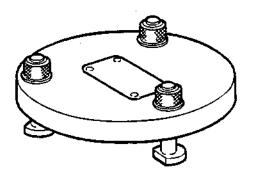
TOOL 204 0.25 X 2.50 IN DIA (10 X 65 MM)



TOOL 198 5.75 X 3.00 X 1.25 IN (150 X 80 X 35 MM)



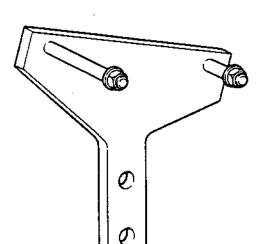
TOOL 313 5.75 X 6.50 IN DIA (150 X 170 MM)



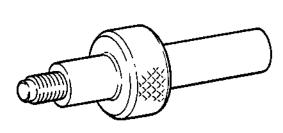
TOOL 199 I.75 X 5.25 IN DIA (45 X 135 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1010

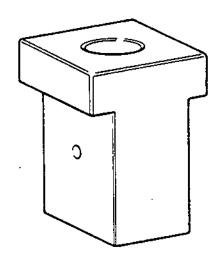
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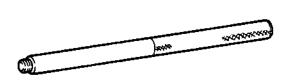
TOOL 151 6.50 X 6.25 X 3.00 IN (170 X 160 X 80 MM)



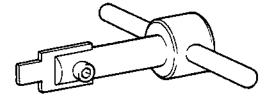
TOOL 158 2.25 X 0.75 IN DIA (60 X 20 MM)



TOOL 159 2.00 X 1.50 X 1.50 IN (55 X 40 X 40 MM)



 $\color{red}\textbf{TOOL}$ 1484 $\color{blue}\textbf{7.00}$ x 0.50 (N DIA (180 X 15 MM)

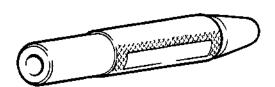


TOOL 1485 2.25 X 2.25 X 0.75 IN (60 X 60 X 20 MM)

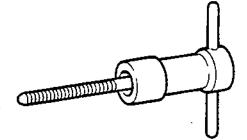
Left-hand Accessory Gearbox - Special Tools Figure 1011

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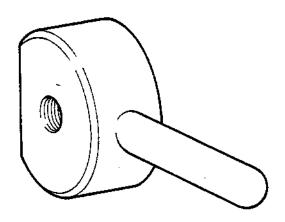
CR 34899/00A



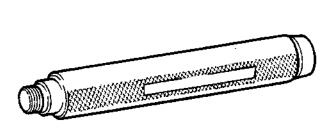
TOOL 1524 5.00 X 0.50 IN DIA (130 X 15 MM)



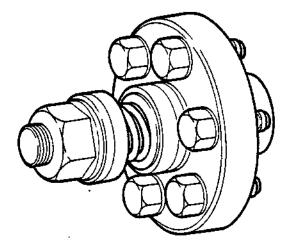
TOOL 272 5.50 x 3.25 x 1.00 IN DIA (140 x 85 x 30 MM)



TOOL 269 3.00 X 1.25 X 0.50 IN (80 X 35 X 15 MM)



TOOL 153 5.50 X 1.00 IN DIA (140 X 30 MM)



TOOL 868 3.25 X 3.00 IN DIA (85 X 80 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1012

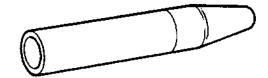
SPECIAL TOOLS ETC.

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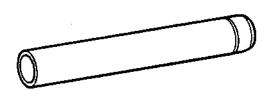
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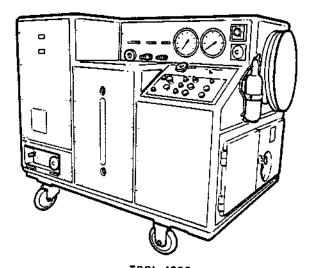
TOOL 1481 6.00 X 0.50 IN (155 X 15 MM)



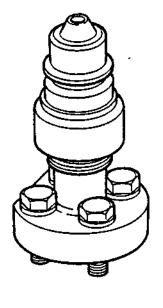
TOOL 271 2.25 X 0.50 IN (60 X 15 MM)



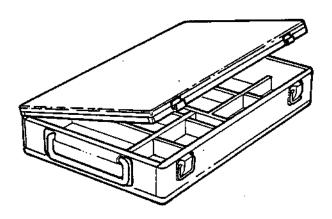
TOOL 1959 2.75 X 0.50 IN DIA (70 X 15 MM)



TOOL 1926 71.00 X 57.00 X 45.00 IN (1805 X 1450 X 1145 MM)



TOOL 704 4.00 X 2.25 IN DIA (105 X 60 MM)



TOOL 799
15.50 X 9.75 X 2.75 IN (395 X 250 X 70 MM)

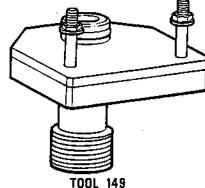
Left-hand Accessory Gearbox - Special Tools Figure 1013

SPECIAL TOOLS ETC.

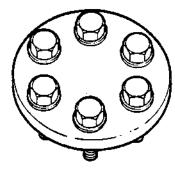
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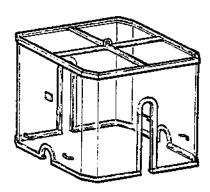




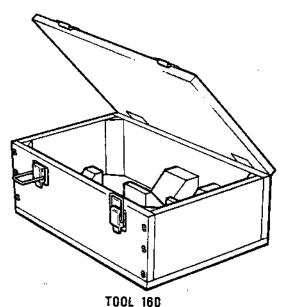
3.00 X 2.75 X 2.50 IN (80 X 70 X 65 MM)



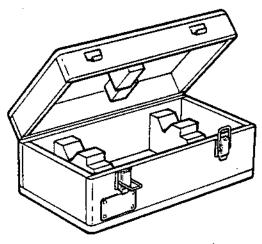
TOOL 150 1.00 X 3.00 IN DIA (30 X 80 MM)



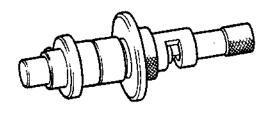
TOOL 797 47.25 X 43.75 X 37.50 1N (1205 X 1115 X 955 MM)



10.50 X 6.25 X 3.50 IN (270 X 160 X 90 MM)



TOOL 161 9.75 X 7.00 X 4.25 IN (250 X 180 X 110 MM)



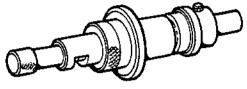
T00L 7 6.75 X 2.50 IN DIA (175 X 65 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1014

SPECIAL TOOLS ETC.

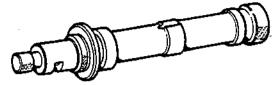
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TOOL 8 8.75 X 2.25 IN DIA (225 X 60 MM)

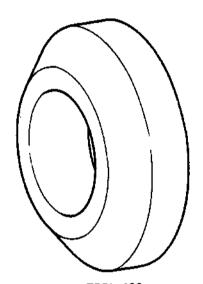
CR 34902/00A



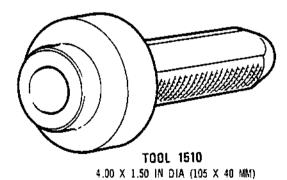
TOOL 6 10.25 X 2.25 IN (265 X 60 MM)



TOOL 9 9.75 X 2.75 IN (250 X 70 MM)



TOOL 162 0.75 X 2.50 IN (20 X 65 MM)

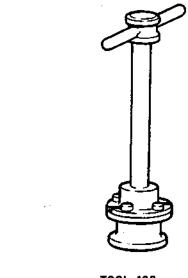




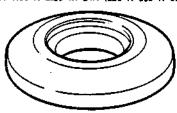
Left-hand Accessory Gearbox - Special Tools Figure 1015

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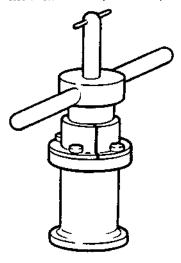
CR 34903/00A



TOOL 163 8.50 X 5.00 X 2.25 IN DIA (220 X 130 X 60 MM)



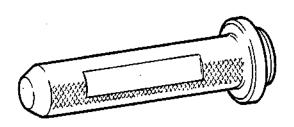
TOOL 175 0.50 X 3.00 IN DIA (15 X 80 MM)



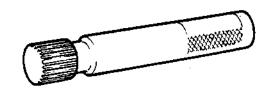
TOOL 176 7.50 X 6.75 X 2.50 IN DIA (195 X 175 X 65 MM)



TOOL 1656 19.50 X 3.25 X 2.50 IN (500 X 85 X 65 MM)



TOOL 1489 3.75 X 1.25 IN DIA (100 X 35 MM)



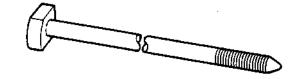
TOOL 10 5.00 X 1.00 (N DIA (130 X 30 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1016

SPECIAL TOOLS ETC.

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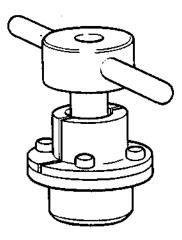




TOOL 307



10.50 X 1.00 IN DIA (270 X 30 MM)

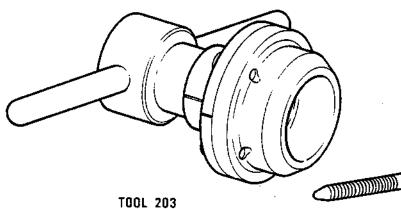


TOOL 306 7.50 X 3.25 X 2.25 IN (195 X 85 X 60 MM)



TOOL 165 10.50 X 1.00 IN DIA (270 X 30 MM)

TOOL 1648 13.00 X 3.25 X 2.50 IN (335 X 85 X 65 MM)



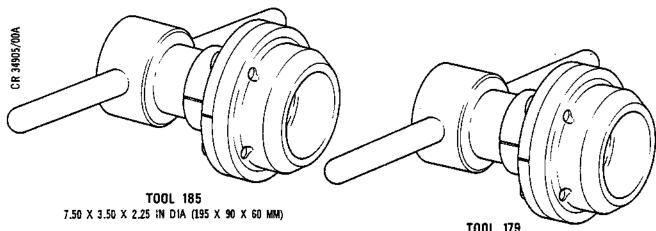
5.50 X 3.50 X 2.25 IN DIA (140 X 90 X 60 MM)



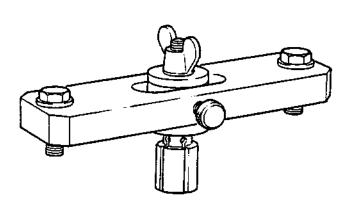
Left-hand Accessory Gearbox - Special Tools Figure 1017

SPECIAL TOOLS ETC.

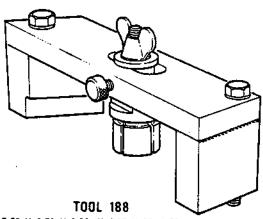
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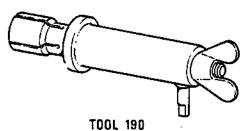
TOOL 179 7.50 X 3.50 X 2.25 IN DIA (195 X 90 X 60 MM)



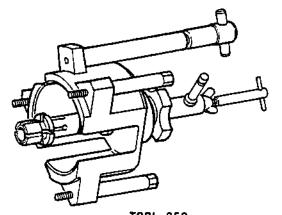
TOOL 189 5.50 x 3.00 x 2.00 IN (140 x 80 x 55 MM)



7.50 X 3.50 X 2.00 IN (195 X 90 X 55 MM)



4.75 X 2.00 IN (125 X 55 MM)



TOOL 953 9.50 X 5.25 IN DIA (245 X 135 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1018

SPECIAL TOOLS ETC.

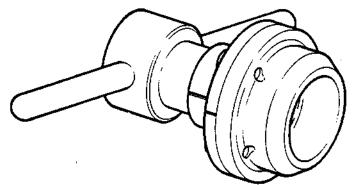
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CR 34906/00A

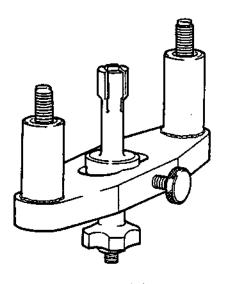


TOOL 182 10.00 X 1.50 IN DIA (255 X 40 MM)

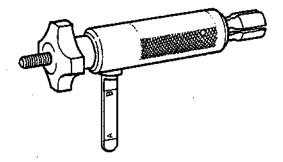


TOOL 181 7.50 X 3.50 X 2.50 IN DIA (195 X 90 X 65 MM)

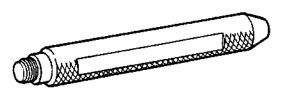
TOOL 184 9.75 X 1.00 IN DIA (250 X 30 MM)



TOOL 912 5,75 X 4.00 X 2,50 IN (150 X 105 X 65 MM)



TOOL 911 4.50 X 2.00 X 1.25 IN (115 X 55 X 35 MM)



TOOL 1505 5.00 X 0.75 IN DIA (130 X 20 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1019

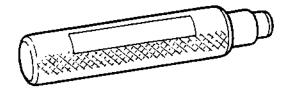
SPECIAL TOOLS ETC.

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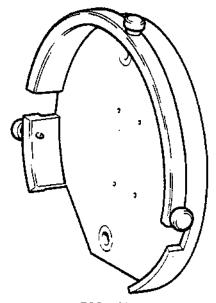




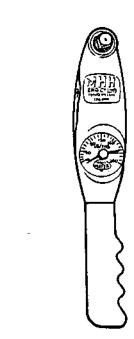
TOOL 194 7.00 X 2.00 IN DIA (180 X 55 MM)



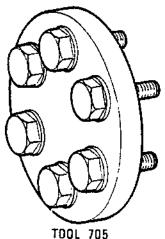
TOOL 193 4.00 X 0.75 IN DIA (105 X 20 MM)



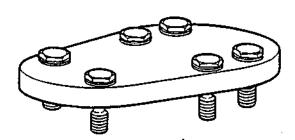
TOOL 222 1.25 X 8.25 IN (35 X 210 MM)



TOOL 1664 10.50 X 2.75 IN (270 X 70 MM)



1.50 X 3.25 IN DIA (40 X 85 MM)

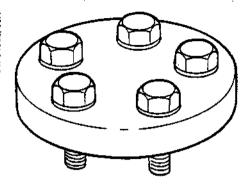


TOOL 218 5.25 X 3.00 X 1.25 MM (135 X 80 X 35 MM)

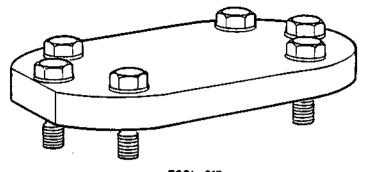
Left-hand Accessory Gearbox - Special Tools Figure 1020

SPECIAL TOOLS ETC.

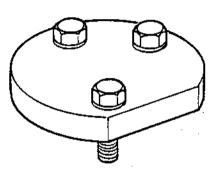
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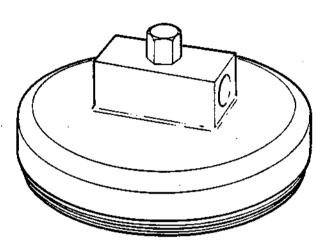
TOOL 219 1.25 X 2.75 IN DIA (35 X 70 MM)



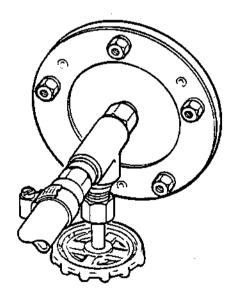
TOOL 217 4.75 X 2.75 X 1.25 IN (125 X 70 X 35 MM)



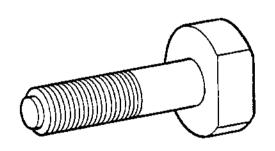
TOOL 281 2.75 X 1.25 IN (70 X 35 MM)



TOOL 650 3.50 X 6.75 IN DIA (90 X 175 MM)



TOOL 915 10.00 X 6.25 X 5.50 IN (255 X 160 X 140 MM)

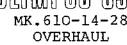


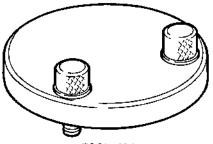
TOOL 86 1.50 X 0.75 IN DIA (40 X 20 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1021

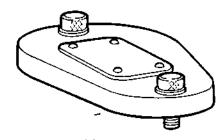
SPECIAL TOOLS ETC.

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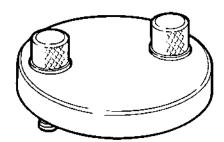




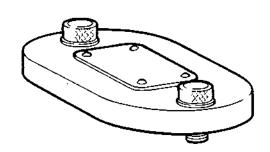
TOOL 124 1.25 X 3.25 IN DIA (35 X 85 MM)



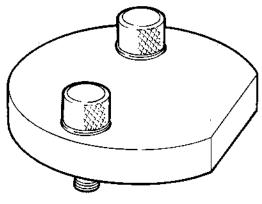
TOOL 122 5.25 X 3.25 X 1.25 IN DIA (135 X 85 X 35 MM)



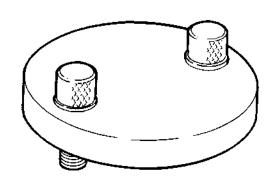
TOOL 123 1.25 X 2.75 IN DIA (35 X 70 MM)



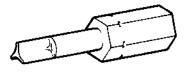
TOOL 120 5.00 × 2.75 × 1.25 IN (130 × 70 × 35 MM)



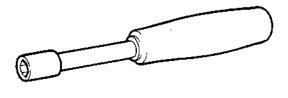
TOOL 282 1.25 X 2.75 IN DIA (35 X 70 MM)



TOOL 201 1.25 X 3.00 IN DIA (35 X 80 MM)



TOOL 1911 1.75 X 0.75 IN (45 X 20 MM)

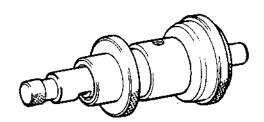


TOOL 1912 7.50 X 1.00 (N (195 X 30 MM)

Left-hand Accessory Gearbox - Special Tools Figure 1022

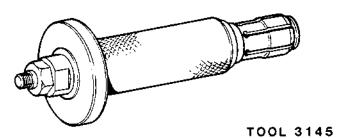
SPECIAL TOOLS ETC.

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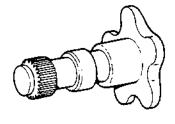


TOOL 3144

7.30 x 2.30 IN DIA (186 x 59 MM)



7.37 x 2.25 IN DIA (187 X 57 MM)

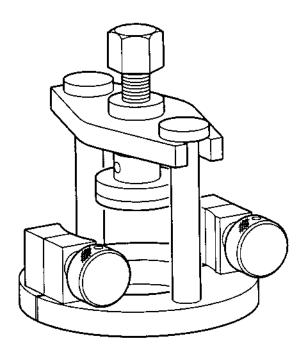


3.30 X 2.20 IN DIA (84 X 56 MM)

Left-Hand Accessory Gearbox - Special Tools Figure 1023

SPECIAL TOOLS ETC.

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TOOL 3150

Left-Hand Accessory Gearbox - Special Tools Figure 1024

SPECIAL TOOLS ETC.

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RIGHT-HAND ACCESSORY GEARBOX - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the right-hand gearbox.
- B. The tools have been listed in order of usage and the Tool Ref. No. is the number quoted in the text. Tools marked with a * are used in more than one aspect of overhaul, and will be duplicated in the tables.
- C. Pictorial views of the tools are illustrated and reference to the relevant Fig. No. is included in the tables.

2. Right-Hand Accessory Gearbox Disassembly Tools

| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|--------------------------|---|------|
| * 792 | P3C.1089432 | Protector, IDG mounting coupling | 1001 |
| * 794 | P3C.1089440 | Adapter, lifting fixture | 1001 |
| * 793 | P3C.1089439 | Adapter, lifting fixture | 1001 |
| * 827 | P3C.1094724 | Lifting fixture, gearbox case | 1001 |
| * 795 | P3C.1089441 | Lifting fixture, gearbox case | 1001 |
| * 494 | P3C.1086847 | Build stand, gearbox | 1002 |
| *3126 | \$3\$.15812000 | Protector, inclined bevel gear drive coupling | 1030 |
| 1336 | P3C.894661 | Deepening tool, keywasher, coupling shaft | 1002 |
| * 536 | P3C.1086894 | Immobilizer, inclined bevel gear | 1002 |
| * 537 | P3C.1086895 | Nut, (part of 536) | 1003 |
| * 535 | P3C.1086893 | Wrench, inclined bevel gear nut | 1003 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.



| 743 P3C.1089332 Mechanical puller, i coupling shaft * 717 P3C.1089310 Support, inclined be bearing housing * 716 P3C.1089309 Driver, inclined bey bearing housing * 723 P3C.1089317 Mechanical puller, i bevel gear 685 PJ.1089249 Support, inclined bey bearing housing 686 P3C.1089250 Driver, inclined bey bearing housing * 778 P3C.1089415 Protector, starter (Application of the protector) * 715 P3C.1089308 Mechanical puller, inclined puller, i | FIG. |
|--|------------------|
| * 717 P3C.1089310 Support, inclined be bearing housing * 716 P3C.1089309 Driver, inclined beyond bearing housing * 723 P3C.1089317 Mechanical puller, inclined beyond gear 685 PJ.1089249 Support, inclined beyond housing 686 P3C.1089250 Driver, inclined beyond bearing housing * 778 P3C.1089415 Protector, starter (178 P3C.1089308 Mechanical puller, inclined beyond the part of th | |
| bearing housing * 716 P3C.1089309 Driver, inclined bearing housing * 723 P3C.1089317 Mechanical puller, inclined bearing housing 685 PJ.1089249 Support, inclined bearing housing 686 P3C.1089250 Driver, inclined bearing housing * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, inclined puller, inclined puller, inclined bearing housing | 1003 |
| * 716 P3C.1089309 Driver, inclined bey bearing housing * 723 P3C.1089317 Mechanical puller, inclined beyond gear 685 PJ.1089249 Support, inclined beyond bearing housing 686 P3C.1089250 Driver, inclined beyond bearing housing * 778 P3C.1089415 Protector, starter (Management of the P3C.1089308 Mechanical puller, inclined beyond bearing housing | ver gear 1003 |
| * 723 P3C.1089317 Mechanical puller, in bevel gear 685 PJ.1089249 Support, inclined be bearing housing 686 P3C.1089250 Driver, inclined bey bearing housing * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, in hollow pins | |
| bevel gear 685 PJ.1089249 Support, inclined be bearing housing 686 P3C.1089250 Driver, inclined bever bearing housing * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, inclined bever bearing housing | 1003 |
| 685 PJ.1089249 Support, inclined be bearing housing 686 P3C.1089250 Driver, inclined bey bearing housing * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, in hollow pins | |
| bearing housing 686 P3C.1089250 Driver, inclined bearing housing to bearing housing P3C.1089415 Protector, starter (P3C.1089308 Mechanical puller, in hollow pins | 1003 |
| 686 P3C.1089250 Driver, inclined better bearing housing * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, inclined between the protector and the protector and the protector inclined between the protector and the protect | er gear 1004 |
| bearing housing * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, i hollow pins | |
| * 778 P3C.1089415 Protector, starter (* 715 P3C.1089308 Mechanical puller, in hollow pins | 1004 |
| * 715 P3C.1089308 Mechanical puller, in hollow pins | |
| | |
| | 1004 |
| * 526 P3C.1086881 Locating pin, front | |
| * 527 P3C.1086882 Locating pin, front | cover 1004 |
| * 528 P3C.1086883 Locating pin, front | |
| *1668 T.914825 Puller, front cover | |
| pump adapter *1867 P5J.1263661 Lifting fixture, from | 1005 |
| *1867 P5J.1263661 Lifting fixture, fro * 430 P3C.1083392 Holding fixture, fro | |
| * 787 P3C.1089426 Immobilizer, oil pun | |
| 969 P3C.1234426 Mechanical puller, of | |
| 1653 P3C.473505 Impact puller, oil p | |
| 902 PJ.1223030 Mechanical puller, | |
| 1702 P3C.473507 Impact puller | 1006 |
| * 431 P3C.1083393 Support, oil filter | |
| * 456 P3C.1086800 Wrench, oil jet (pre | |
| 1868 P5J.1294567 Puller, hollow pins, mounting face | oil pump |
| *1579 P3C.1229389 Crowfoot wrench, rel cap (pre SB.72-8) | |
| *1972 P3C.1262635 Crowfoot wrench, rel cap (SB.72-8) | |
| *1477 P3C.1050093 Wrench, relief valve | retaining |
| * 505 P3C.1086861 Protector, front covinlet face | 1007 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|--------------------------|---|-------------|
| * 506 | P3C.1086862 | Protector, front cover, oil | |
| | | return face | 100 |
| 507 | P3C.1086863 | Protector, front cover, oil pressure switch and transmitter | 100 |
| 508 | P3C.1086864 | Protector, front cover, starter mounting face | 100 |
| 509 | P3C.1086865 | Protector, front cover, mounting face | 100 |
| * 510 | P3C.1086866 | Container, front cover | 100 |
| * 669 | P3C.1089227 | Immobilizer, starter/IDG drive shaft | 100 |
| 1700 | PJ.1244665 | Mechanical puller, oil transfer housing | 100 |
| * 670 | P3C.1089228 | Wrench, starter/IDG drive shaft nut | 100 |
| * 724 | P3C.1089318 | Mechanical puller, starter/IDG drive shaft | 100 |
| * 653 | P3C.1089215 | Wrench, starter/IDG drive shaft | 100 |
| * 654 | P3C.1089216 | Holder, vice, starter/IDG drive shaft | 100 |
| 735 | P3C.1089324 | Mechanical puller, starter/IDG drive shaft | 100 |
| * 658 | P3C.1089220 | Holder, vice, vertical bevel gear drive shaft | 100 |
| * 657 | P3C.1089219 | Wrench, vertical bevel gear | |
| | | drive shaft nut | 100 |
| * 736 | P3C.1089325 | Mechanical puller, vertical bevel gear assembly | 101 |
| * 646 | P3C.1089206 | Holder, vice, vertical bevel | |
| | | gear assembly | 101 |
| * 647 | P3C.1089207 | Wrench, vertical bevel gear assembly nut | 103 |
| 746 | P3C.1089335 | Mechanical puller, vertical bevel gear assembly | 103 |
| 744 | P3C.1089333 | Mechanical puller, vertical bevel gear assembly | 10: |
| * 540 | P3C.1086898 | Immobilizer, hydraulic pump drive shaft | 10: |

Disassembly Tools Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|----------------------------|---|--------------|
| 1608 | PJ.1234556 | Guide, hydraulic pump drive | |
| *1505 | 707 1006060 | shaft | 1011 |
| *1525 | P3C.1086868 | Wrench, hydraulic pump drive shaft nut | 1011 |
| * 645 | P3C.1089204 | Cranked wrench, main hydraulic | TOTT |
| * | | pump adapter nut | 1011 |
| 707 | P3C.1089300 | Support, main hydraulic pump | |
| | | adapter | 1011 |
| 708 | P3C.1089301 | Driver, main hydraulic pump | |
| * 51.2 | P3C.1086870 | adapter | 1011 |
| - 212 | P3C.1000010 | Holder, vice, hydraulic pump drive shaft | 1011 |
| 747 | P3C.1089337 | Mechanical puller, hydraulic | TOTT |
| | | pump drive shaft | 1012 |
| 1707 | P3C.1089341 | Adapter, hydraulic pump adapter | |
| | | jet | 1012 |
| 1701 | P3C.473506 | Impact puller, general purpose | 1012 |
| 745 | P3C.1089334 | Mechanical puller, spur gear shaft ball bearing | 1010 |
| * 642 | P3C.1089201 | Immobilizer, oil pump idler gear | 1012 1012 |
| * 643 | P3C.1089202 | Wrench, oil pump idler gear nut | 1012 |
| 741 | P3C.1089330 | Mechanical puller, idler shaft | 1013 |
| * 652 | P3C.1089214 | Immobilizer, oil pump drive | 1013 |
| * 651 | P3C.1089213 | Wrench, oil pump drive spur | |
| | | gear nut | 1013 |
| 739 | P3C.1089328 | Mechanical puller, oil pump drive | 1013 |
| * 493 | P3C.1086845 | Retainer, strainer housing | 1013 |
| 742 | P3C.1089331 | Puller, strainer housing | 1013 |
| 765 | P3C.1089346 | Adapter, hollow pin (pre SB.72-24) | 1014 |
| 779 | P3C.1089416 | Adapter, strainer assembly main | 1014 |
| 777 | P3C.1089412 | hydraulic pump mounting face | 1014 |
| | P3C.1089417 | Mechanical driver, stepped pin | 1014 |
| 780 734 | P3C.1089344 | Adapter, jet from case | 1014 |
| 734 | | Adapter, hollow pin (pre SB.72-24) | 1014 |
| 1869 1870 | P5J.1259796 P5J.1259797 | Adapter, hollow pin (SB.72-24) | 1015 |
| | | Adapter, hollow pin (SB.72-24) | 1015 |
| 768 767 | P3C.1089349 | Adapter, hollow pin (pre SB.72-24) | 1015 |
| 767 | PJ.1089348 | Adapter, hollow pin (SB.72-24) | 1015 |
| 770 | P3C.1089400 | Protector, inclined bevel gear | 1015 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|------------------|--------------------------|-------------------------------------|-------------|
| 1878 | P3C.1089402 | Protector, main hydraulic pump | 1015 |
| 3078 | P3C.1089403 | Protector, stand-by hydraulic | |
| | | pump | 1016 |
| 3079 | P3C.1089404 | Protector, front cover mountin face | g 1016 |
| 3075 | P3C.1089406 | Protector, small cover | 1016 |
| 776 | P3C.1089411 | Protector, scavenge and pressu | re |
| | · | filter | 1016 |
| 3076 | P3C.1089401 | Protector, IDG mounting | 1016 |

Disassembly Tools Table 1001 (Concluded)

3. Right-Hand Accessory Gearbox Assembly Tools

| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|--------------------------|---|------|
| 514 | P3C.1086875 | Driver, hollow pin | 1017 |
| 517 | P3C.1086878 | Driver, hollow pin | 1017 |
| 516 | P3C.1086877 | Driver, hollow pin | 1017 |
| 518 | P3C.1086879 | Driver, front sleeve | 1017 |
| 42 | P3C.1089222 | Gauge, stepped pin, main hydraulic pump mounting face | 1017 |
| 665 | P3C.1089221 | Driver, stepped pin, main | |
| 401 | nag 1006043 | hydraulic pump mounting face | 1017 |
| 491 | P3C.1086843 | Guide, strainer housing | 1018 |
| 492 | P3C.1086844 | Driver, strainer housing | 1018 |
| 952 | P3C.1229354 | Mechanical driver, stepped pins, inclined bevel gear drive assembly | 1018 |
| 429 | P3C.1083391 | Driver, hollow pin, front cover | 1018 |
| 515 | P3C.1086876 | Driver, stepped pin, main hydraulic pump adapter | 1018 |
| 539 | P3C.1086897 | Driver, stepped pin, stand-by hydraulic pump adapter | 1018 |
| 428 | P3C.1083390 | Driver, hollow pin, scavenge pump case | 1019 |

Assembly Tools
Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|----------------------------|--|------|
| 538 | P3C.1086896 | Driver, rear sleeve | 1019 |
| 709 | P3C.1089302 | Support, flexible coupling shaft | 1019 |
| 710 | P3C.1089303 | Driver, spacer sleeve | 1019 |
| * 430 | P3C.1083392 | Holding fixture, front cover | 1005 |
| * 431 | P3C.1083393 | Support, oil filter (pre SB.72-23) | |
| * 456 | P3C.1086800 | Wrench, oil jet (pre SB.72-23) | 1006 |
| * 787 | P3C.1089426 | Immobilizer, oil pump drive shaft | 1005 |
| *1477 | P3C.1050093 | Wrench, relief valve retaining sleeve | 1007 |
| 1587 | P3C.1234508 | | |
| *1579 | P3C.1234506 P3C.1229389 | Adapter, relief valve cap | 1019 |
| | | Crowfoot wrench, relief valve cap (pre SB.72-8) | 1007 |
| *1972 | P3C.1262635 | Crowfoot wrench, relief valve cap (SB.72-8) | 1007 |
| * 778 | P3C.1089415 | Protector, starter QAD coupling | 1004 |
| * 510 | P3C.1086866 | Container, front cover | 1008 |
| * 794 | P3C.1089440 | Adapter, lifting fixture | 1001 |
| * 793 | P3C.1089439 | Adapter, lifting fixture | 1001 |
| * 827 | P3C.1094724 | Lifting fixture, gearbox case | 1001 |
| * 795 | P3C,1089441 | Lifting fixture, gearbox case | 1001 |
| * 494 | P3C.1086847 | Build stand, gearbox | 1002 |
| * 493 | P3C.1086845 | Retainer, strainer housing | 1013 |
| 644 | P3C.1089203 | Adapter, flow check | 1019 |
| 997 | PJ.1234581 | Adapter, flow check blank, IDG mounting face | 1020 |
| 1926 | \$38,10753000 | Test rig, mobile, oil pressure | 1020 |
| 513 | P3C.1086874 | Guide sleeve, bolt retaining | |
| | | ring | 1020 |
| 727 | P3C.1089321 | Container, flow check equipment | 1020 |
| 500 | P3C.1086856 | Support, inclined bevel gear drive assembly | 1020 |
| 501 | P3C.1086857 | Driver, inclined bevel gear | |
| 502 | PJ.1086858 | drive assembly Driver, inclined bevel gear | 1020 |
| 37 | P3C.1086849 | drive assembly Checking gauge, vertical bevel | 1021 |
| J, | 130,1000043 | gear drive assembly | 10 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|-----------------------|--|------|
| 498 | PJ.1086854 | Hand nut, gauge (37) | 1021 |
| 3077 | P3C.1086848 | Fixture, front cover, bevel | |
| 405 | D3G 10060F1 | gear adjusting washers | 1021 |
| 495 | P3C.1086851 | Hand nut, gauge (37) | 1021 |
| 38 | P3C.1086850 | Checking gauge, inclined bevel | 1021 |
| 496 | P3C.1086852 | gear drive assembly Spacer ring, gauge (38) | 1021 |
| 497 | P3C.1086853 | Hand nut, gauge (38) | 1022 |
| 499 | P3C.1086855 | Container, bevel gear adjusting | 1022 |
| 433 | 1 30.1000033 | washer gauges | 1022 |
| 483 | P3C.1086841 | Support, stand-by hydraulic | |
| | 100.12000011 | pump drive | 1022 |
| 490 | P3C.1086842 | Driver, stand-by hydraulic | |
| | | pump drive | 1022 |
| * 512 | P3C.1086870 | Holder, vice, hydraulic pump spur | |
| | | gear assembly | 1011 |
| *1525 | P3C.1086868 | Wrench, hydraulic pump spur gear | 1011 |
| E03 | D3G 10868E0 | assembly | 1011 |
| 503 | P3C.1086859 | Support, stand-by hydraulic sealol seal | 1022 |
| 504 | P3C.1086860 | Driver, stand-by hydraulic | 1022 |
| 304 | L2C*T000000 | sealol seal | 1023 |
| 672 | P3C.1089230 | Support, oil pump drive | 1023 |
| 671 | P3C.1089229 | Driver, oil pump drive | 1023 |
| * 652 | P3C.1089214 | Immobilizer, oil pump drive | 1013 |
| * 651 | P3C.1089213 | Wrench, oil pump drive spur gear | |
| ••• | - 551-157-1-5 | nut | 1013 |
| 529 | P3C.1086887 | Support, idler gear shaft | 1023 |
| 530 | P3C.1086888 | Driver, idler gear shaft | 1023 |
| 541 | P3C.1086900 | Mechanical puller, idler gear | |
| | | shaft | 1023 |
| * 642 | P3C.1089201 | Immobilizer, idler gear assembly | 1012 |
| * 643 | P3C.1089202 | Wrench, idler gear assembly | 1012 |
| * 540 | P3C.1086898 | Immobilizer, hydraulic pump drive shaft | 1010 |
| * 645 | P3C.1089204 | Cranked wrench, main hydraulic | |
| | | pump adapter nut | 1011 |
| 666 | P3C.1089223 | Peening tool, hydraulic pump | |
| | - | drives | 1024 |

Assembly Tools
Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|-----------------------|---|------|
| 667 | P3C.1089224 | Adapter, hydraulic pump drives | 1024 |
| 233 | P3C.1072801 | Peening fixture, hydraulic pump drives | 1024 |
| 533 | P3C.1086891 | Support, vertical bevel gear assembly | 1024 |
| 534 | P3C.1086892 | Driver, vertical bevel gear | |
| * 646 | P3C.1089206 | assembly Holder, vice, vertical bevel gear | 1024 |
| | | assembly | 1010 |
| * 647 | P3C.1089207 | Wrench, vertical bevel gear assembly nut | 1010 |
| * 658 | P3C.1089220 | Holder, vice, vertical bevel gear drive shaft | 1009 |
| * 657 | P3C.1089219 | Wrench, vertical bevel gear drive shaft nut | |
| 965 | P3C.1234411 | Immobilizer, vertical bevel gear drive shaft | 1009 |
| 648 | P3C.1089210 | Support, starter/IDG spur gear assembly | 1024 |
| 649 | P3C.1089211 | Driver, starter/IDG spur gear assembly | 1025 |
| * 653 | P3C.1089215 | Wrench, starter/IDG spur gear | |
| * 654 | P3C.1089216 | assembly Holder, vice, starter/IDG spur | 1009 |
| | | gear assembly | 1009 |
| 531 | P3C.1086889 | Support, inclined bevel gear drive assembly | 1025 |
| 532 | P3C.1086890 | Driver, inclined bevel gear | |
| 728 | P3C.1089323 | drive assembly Slave nut, inclined bevel gear | 1025 |
| * 536 | P3C.1086894 | drive assembly Immobilizer, inclined bevel gear | 1025 |
| * 537 | P3C.1086895 | nut (part of 536) Nut (part of 536) | 1002 |
| * 535 | P3C.1086893 | Wrench, inclined bevel gear nut | 1003 |
| * 526 | P3C.1086881 | Locating pin, front cover | 1003 |
| * 527 | P3C.1086882 | Locating pin, front cover | 1004 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|--------------------------|--|------|
| * 528 | P3C.1086883 | Locating pin, front cover | 1005 |
| *1867 | P5J.1263661 | Lifting fixture, front cover | 1005 |
| 766 | P3C.1089442 | Driver, flanged dowels front cover | 1025 |
| 714 | P3C.1089307 | Indicating fixture, bevel gear backlash check | 1026 |
| * 717 | P3C.1089310 | Support, inclined bevel gear bearing housing | 1003 |
| * 716 | P3C.1089309 | Driver, inclined bevel gear | |
| | | bearing housing | 1003 |
| * 723 | P3C.1089317 | Mechanical puller, inclined | |
| | | bevel gear | 1003 |
| * 715 | P3C.1089308 | Mechanical puller, front cover | 1004 |
| | | hollow pins | 1004 |
| *1668 | T.914825 | Puller, front cover | 1003 |
| * 736 | P3C.1089325 | Mechanical puller, vertical bevel gear assembly | 1010 |
| 719 | P3C.1089312 | Guide, starter/IDG spur gear installation | 1026 |
| 720 | P3C.1089313 | Adapter, starter/IDG spur gear installation | 1026 |
| 721 | P3C.1089314 | Adapter, starter/IDG spur gear installation | 1026 |
| 718 | P3C.1089311 | Mechanical driver, starter/IDG | 1010 |
| , 10 | 100,110,0111 | spur gear installation | 1026 |
| * 670 | P3C.1089228 | Wrench, starter/IDG spur gear | 1008 |
| * 669 | P3C.1089227 | <pre>Immobilizer, starter/IDG spur gear</pre> | 1008 |
| 711 | P3C.1089304 | Indicating fixture, starter/IDG | |
| • | | spur gear drive backlash | 1026 |
| 748 | P3C.1089339 | Adapter, backlash checks | 1027 |
| 726 | P3C.1089320 | Indicating fixture, hydraulic pump drive backlash | 1027 |
| 712 | P3C.1089305 | Immobilizer, idler gear shaft backlash | 1027 |
| 725 | P3C.1089319 | Indicating fixture, starter/IDG spur gear backlash | 1027 |
| 713 | P3C.1089306 | Indicating fixture, oil pump drive backlash | 1027 |

Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

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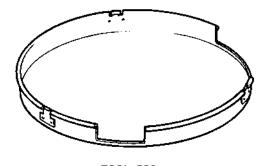
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| TOOL REF. NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|------------------|-----------------------|--|------|
| * 724 | P3C.1089318 | Mechanical puller, starter/IDG spur gear | 1009 |
| 786 | P3C.1089425 | Peening tool, starter/IDG spur gear drive | 1027 |
| 1708 | T.284004 | Peening tool, inclined bevel gear nut | 1028 |
| 740 | P30.1089329 | Test blank, IDG mounting | 1028 |
| 722 | P3C.1089316 | Test blank, starter mounting | 1028 |
| 3125 | \$3\$.15813000 | Test blank, inclined bevel gear drive mounting | 4075 |
| | | (SB.72-8689-272) | 1030 |
| 771 | P3C.1089405 | Test blank, oil inlet | 1028 |
| 773 | P3C.1089408 | Test blank, oil scavenge | 1028 |
| 772 | P3C.1089407 | Test blank, oil pressure | 4000 |
| | | transmitter and switch | 1028 |
| 791 | P3C.1089431 | Container, test blanks | 1029 |
| 555 | P3C.1257447 | Adapter, pressure test, scavenge filter (Pre.SB.72-9036-419) | 1002 |
| 3149 | \$3\$.20556000 | Adapter, pressure test, scavenge filter (SB.72-9036-419) | 1002 |
| 789 | P3C.1089429 | Test adapter, scavenge filter (Pre.SB.72-9036-419) | 1029 |
| 790 | P3C.1089430 | Test adapter, pressure test, pressure filter | |
| | | (Pre.SB.72-9036-419) | 1031 |
| 3151 | s3s.20557000 | Test adapter, pressure test, | 4074 |
| | | pressure filter (SB.72-9036-419) | 1031 |
| 797 | P3C.1089446 | Protection cover, pressure test | 1029 |
| *3126 | s3s.15812000 | Protector, inclined bevel gear drive coupling (SB.72-8689-272) | 1030 |
| * 505 | P3C.1086861 | Protector, front cover, oil inlet face | 1007 |
| * 506 | P3C.1086862 | Protector, front cover, oil return face | 1007 |
| * 792 | P3C.1089432 | Protector, IDG mounting coupling | 1001 |
| 1911 | 1702113 | Tri-wing bit | 1029 |
| 1912 | 1701234 | Tri-wing bit holder | 1029 |

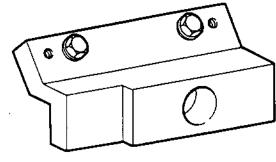
Assembly Tools Table 1002 (Concluded)

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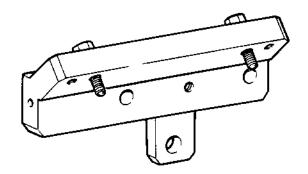
Page 1010 Dec 30/98 CR 35010/00A



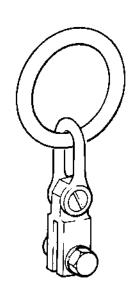
TOOL 792 1.25 X 11.25 IN DIA (35 X 300 MM)



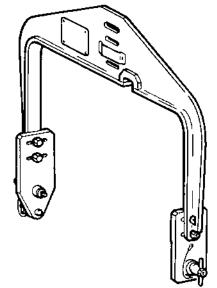
TOOL 794 6.00 X 3.25 X 2.75 IN (155 X 85 X 70 MM)



TOOL 793 7.50 X 4.50 X 2.75 IN (195 X 115 X 70 MM)



TOOL 827 7.75 X 5.25 X 2.25 IN (200 X 135 X 60 MM)



TOOL 795 33.00 X 24.00 X 3.50 IN (840 X 610 X 90 MM)

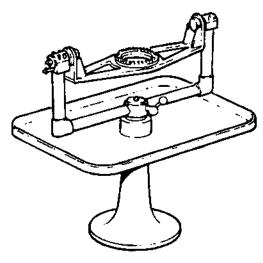
Right-hand Accessory Gearbox - Special Tools Figure 1001

SPECIAL TOOLS ETC.

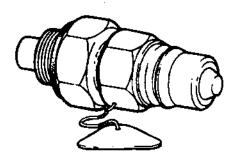
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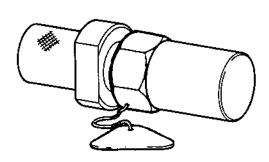




TOOL 494 71.00 X 48.00 X 42.00 IN (1805 X 1220 X 1070 MM)



TOOL 555 3.50 X 1.50 IN (90 X 40 MM)



TOOL 3149



TOOL 536 4.25 X 6.25 IN DIA (110 X 160 MM)

TOOL 1336

11.00 X 0.50 IN DIA (280 X 15 MM)

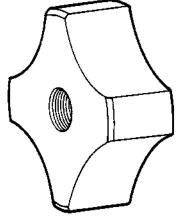
Right-hand Accessory Gearbox - Special Tools Figure 1002

SPECIAL TOOLS ETC.

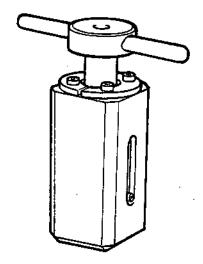
72-63-00 Page 1012 Dec 30/98



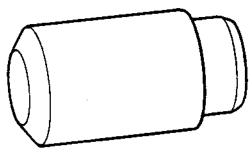
CR 35012/00A



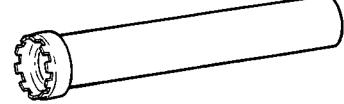
TGOL 537 0.50 X 0.75 IN DIA (15 X 20 MM)



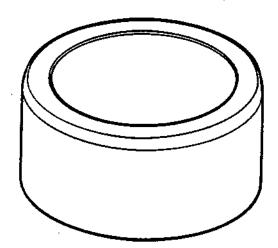
TOOL 743 6.00 X 6.00 X 2.25 IN (155 X 155 X 60 MM)



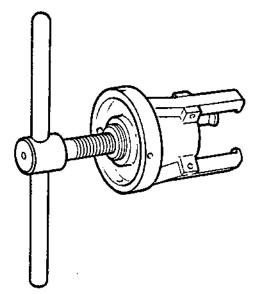
TOOL 716 3.25 X 1.75 IN DIA (85 X 45 MM)



TOOL 535 12.75 X 2.50 IN DIA (325 X 65 MM)



TOOL 717 2.75 X 5.75 IN DIA (70 X 150 MM)



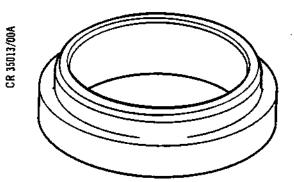
TOOL 723 10.00 X 8.75 X 3.75 IN DIA (255 X 225 X 100 MM)

Right-hand Accessory Gearbox - Special Tools Figure 1003

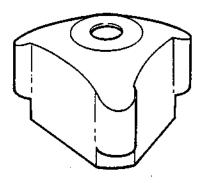
SPECIAL TOOLS ETC.

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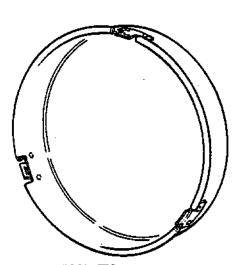




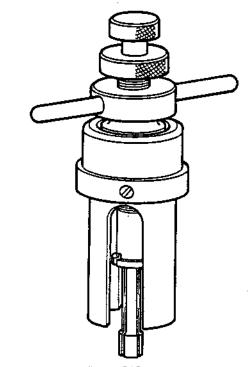
TOOL 685 1.00 X 4.00 IN DIA (30 X 105 MM)



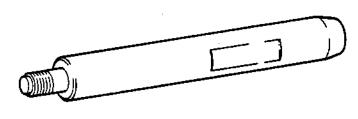
TOOL 686 2.50 X 2.25 X 1.75 IN (65 X 60 X 45 MM)



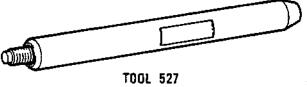
TOOL 778 1.25 X 6.25 IN DIA (35 X 160 MM)



TOOL 715 5.50 X 3.75 X 1.75 IN (140 X 100 X 45 MM)



TOOL 526 4.75 X 0.50 IN (125 X 15 MM)



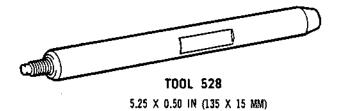
5.00 X 0.50 IN DIA (130 X 15 MM)

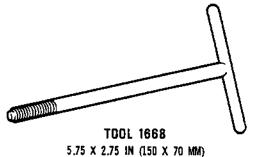
Right-hand Accessory Gearbox - Special Tools Figure 1004

SPECIAL TOOLS ETC.

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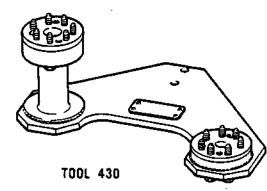
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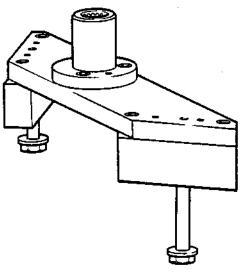


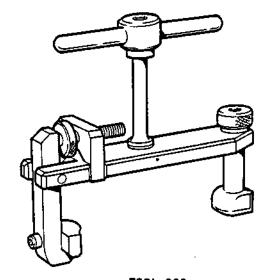
TOOL 1867

15.00 X 11.75 X 1.00 IN (385 X 300 X 30 MM)



14.00 X 10.50 X 6.00 IN (350 X 270 X 155 MM)





TOOL 787 10.00 X 5.50 X 2.75 IN (255 X 140 X 70 MM) TOOL 969 5.50 X 5.00 X 1.75 IN (140 X 130 X 45 MM)

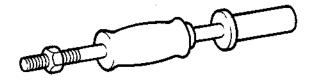
Right-hand Accessory Gearbox - Special Tools Figure 1005

SPECIAL TOOLS ETC.

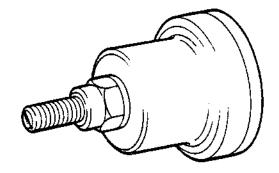
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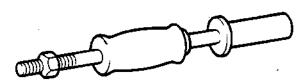




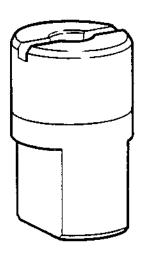
TOOL 1653 10.50 X 0.25 IN DIA (270 X 10 MM)



TOOL 902 2.00 X 1.25 IN DIA (55 X 35 MM)



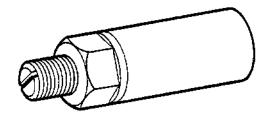
TOOL 1702 11.50 X 0.375 IN DIA (295 X 10 MM)



TOOL 431 2.75 X 1.75 IN DIA (70 X 45 MM)



TOOL 456 5.50 X 1.25 X 0.25 IN (140 X 35 X 10 MM)

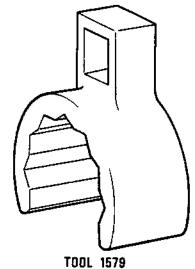


TOOL 1868 2.25 X 0.75 IN DIA (60 X 20 MM)

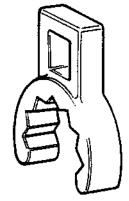
SPECIAL TOOLS ETC.

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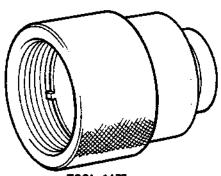
CR 35016/00A



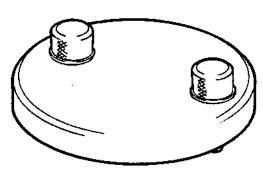
TOOL 1579
2.25 X 2.00 X 1.00 IN (60 X 55 X 30 MM)



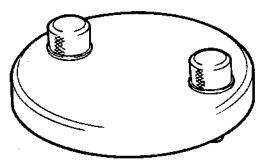
TOOL 1972 2.00 X 1.00 X 0.50 1N (55 X 30 X 15 MM)



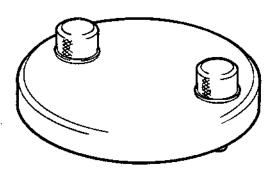
T901 1477 2.00 X 1.50 IN DIA (55 X 40 MM)



TOOL 505 1.25 X 2.75 IN DIA (35 X 70 MM)



TOOL 506 1.25 X 2.75 IN (35 X 70 MM)



TOOL 507 1.25 X 3.25 IN DIA (35 X 85 MM)

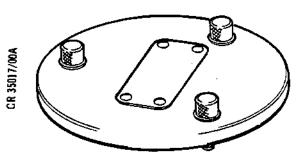
Right-hand Accessory Gearbox - Special Tools Figure 1007

SPECIAL TOOLS ETC.

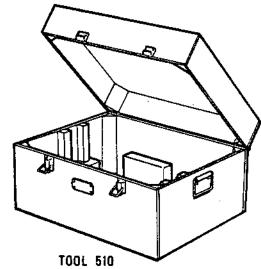
72-63-00

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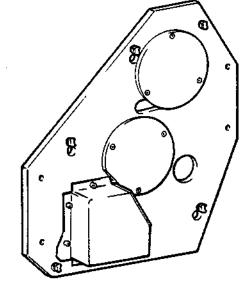




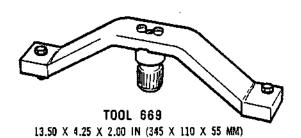
TOOL 508 1.25 X 5.75 IN DIA (35 X 150 MM)

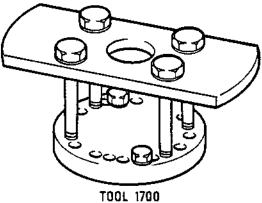


22.25 X 21.25 X 13.00 IN (570 X 540 X 335 MM)

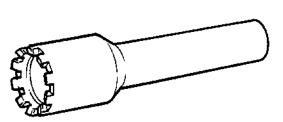


TOOL 509 19.75 X 18.00 X 5.50 IN (505 X 460 X 140 MM)





9.00 X 5.25 X 4.75 IN DIA (230 X 135 X 125 MM)



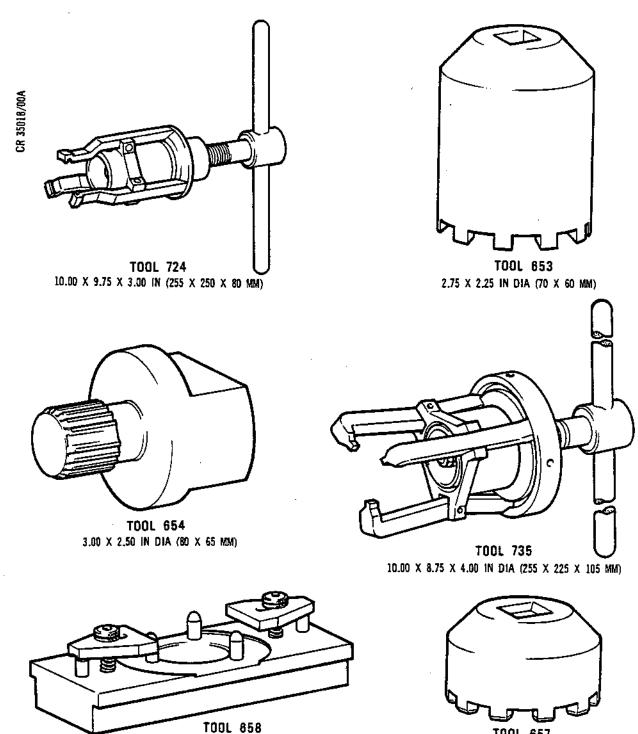
TOOL 670 8.00 X 2.00 IN DIA (205 X 55 MM)

SPECIAL TOOLS ETC.

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Right-hand Accessory Gearbox - Special Tools Figure 1009

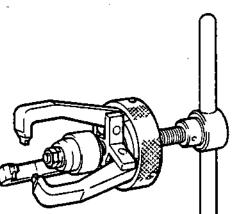
9.50 X 4.00 X 3.00 IN (245 X 105 X 80 MM)

SPECIAL TOOLS ETC. Page 1019 Nov 1/78

TOOL 657

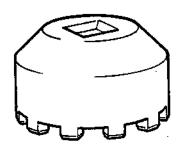
1.75 X 2.25 IN DIA (45 X 60 MM)



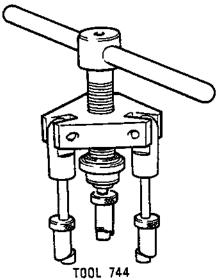


CR 35019/00A

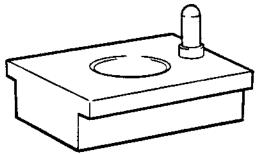
TOOL 736 8.00 X 8.00 X 3.50 IN (205 X 205 X 90 MM)



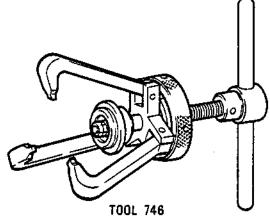
TOOL 647 I.50 X 2.25 IN DIA (40 X 60 MM)



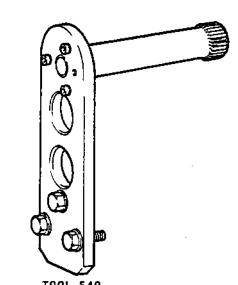
100L 744 12.00 X 7.25 X 3.75 IN (305 X 185 X 100 MM)



TOOL 648 4.00 x 3.25 x 2.50 IN (105 x 85 x 65 MM)



8.00 X 7.25 X 3.50 IN (205 X 185 X 90 MM)



TOOL 540 10.25 X 8.00 X 3.25 IN (265 X 205 X 85 MM)

Right-hand Accessory Gearbox - Special Tools Figure 1010

SPECIAL TOOLS ETC.

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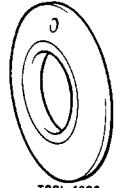
Nov 1/78



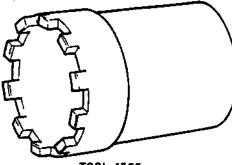
MK.610-14-28 OVERHAUL



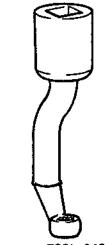
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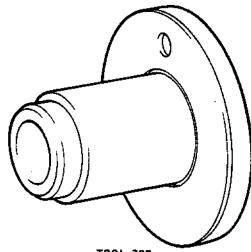
TOOL 1608 0.50 X 5.25 IN DIA (15 X 135 MM)



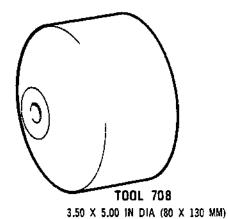
TOOL 1525 4.00 X 2.50 IN DIA (105 X 65 MM)

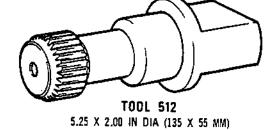


TOOL 645 4.25 X 1.50 X 1.00 IN (110 X 40 X 30 MM)



TOOL 707 4.25 X 5.50 IN DIA (110 X 140 MM)

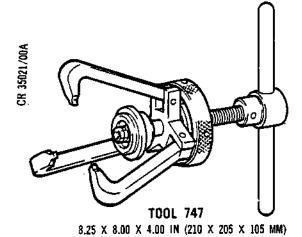


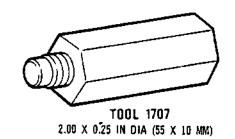


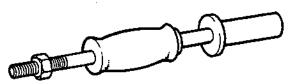
Right-hand Accessory Gearbox - Special Tools Figure 1011

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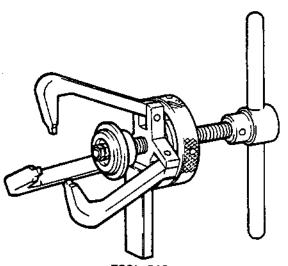
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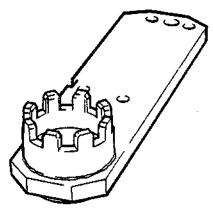




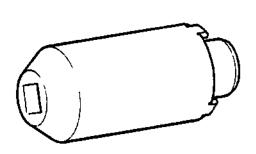
TOOL 1701 12.50 X 0.3125 IN DIA (320 X 10 MM)



TOOL 745 9.25 X 8.00 X 6.00 IN (235 X 205 X 155 MM)



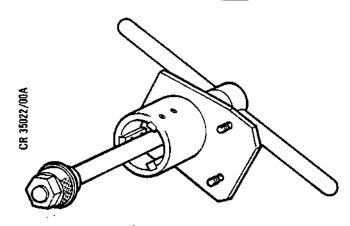
TOOL 642 7.75 X 2.00 X 1.75 IN (200 X 55 X 45 MM)

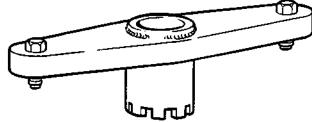


TOOL 643 4.00 X 1.75 IN OIA (105 X 45 MM)

SPECIAL TOOLS ETC.

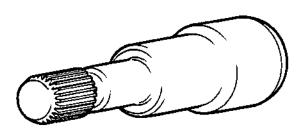
72-63-00 Page 1022 Nov 1/78



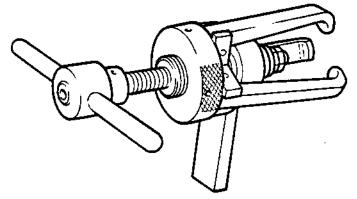


TOOL 652 8.50 X 2.50 X 2.00 IN (220 X 65 X 55 MM)

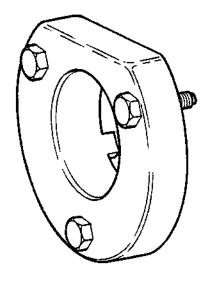
TOOL 741 12.00 X 10.00 X 3.00 IN (305 X 255 X 80 MM)



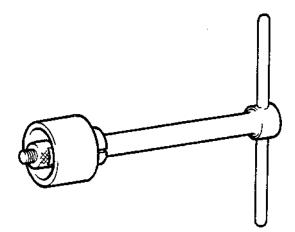
TOOL 651 4.50 X 1.00 IN DIA (115 X 30 MM)



TOOL 739 8.00 X 8.00 X 2.50 IN (205 X 205 X 65 MM)



TOOL 493 3.50 X 1.50 X 4.00 IN DIA (90 X 40 X 105 MM)

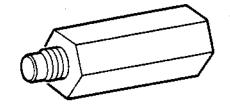


TOOL 742 12.50 X 10.00 X 3.00 IN (320 X 255 X 80 MM)

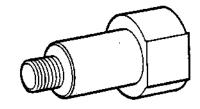
SPECIAL TOOLS ETC.

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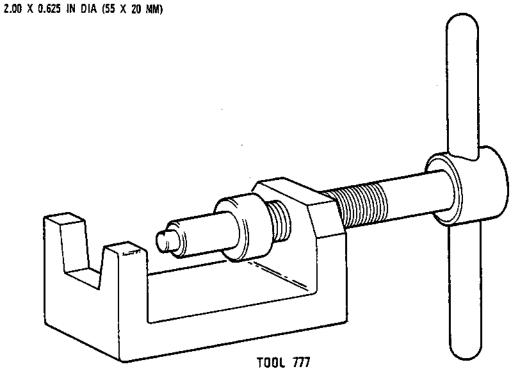


TOOL 765



TOOL 779

1.50 X 0.75 IN DIA (40 X 20 MM)

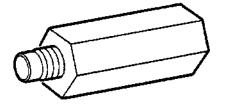


5.75 X 5.00 X 2.00 IN (150 X 130 X 55 MM)



TOOL 780

4.75 X 0.75 IN DIA (125 X 20 MM)



TOOL 734

2.00 X 0.437 IN DIA (55 X 15 MM)

Right-hand Accessory Gearbox - Special Tools Figure 1014

SPECIAL TOOLS ETC.

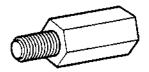
72-63-00

Page 1024 Nov 1/78 CR 35024/00A

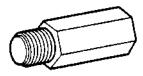


MK.610-14-28 OVERHAUL

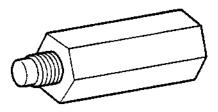




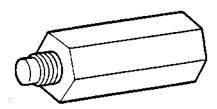
TOOL 1869 1.75 X 0.375 IN DIA (45 X 10 MM)



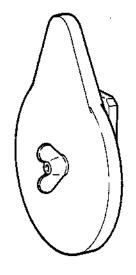
TOOL 1870 1.75 X 0.50 IN DIA (45 X 15 MM)



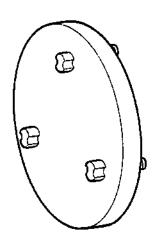
TGOL 768 2.00 X 1.00 IN DIA (55 X 30 MM)



TOOL 767 2.00 X 0.875 IN DIA (55 X 25 MM)



TOOL 770 2.50 X 7.75 IN DIA (65 X 200 MM)



TOOL 1878 1.50 X 7.00 IN DIA (40 X 180 MM)

Right-hand Accessory Gearbox - Special Tools Figure 1015

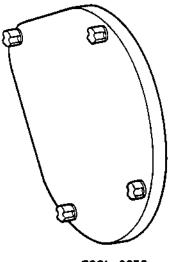
SPECIAL TOOLS ETC.

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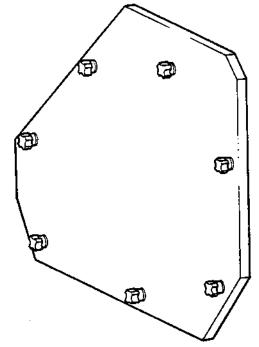
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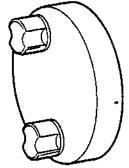




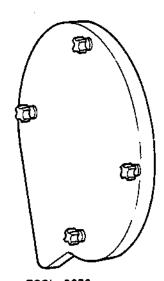
TOOL 3078 9.50 X 1.50 IN (245 X 40 MM)



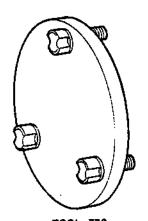
TOOL 3079 19.25 X 14.50 X 0.50 IN (490 X 370 X 15 MM)



TOOL 3075 1.25 X 2.50 IN DIA (35 X 65 MM)



TOOL 3076 1.50 X 10.75 IN DIA (40 X 275 MM)

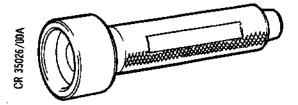


TOOL 776 1.25 X 3.50 IN DIA (35 X 90 MM)

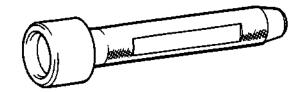
SPECIAL TOOLS ETC.

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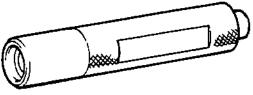




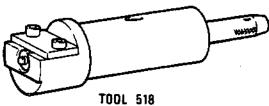
TOOL 574 4.50 X 1.50 IN DIA (115 X 40 MM)



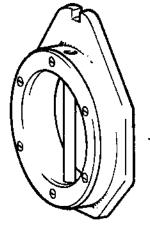
TOOL 517 4.50 X 1.00 IN DIA (115 X 30 MM)



TOOL 516 4.50 X 0.75 IN DIA (115 X 20 MM)



TOOL 518 6.50 X 1.50 IN DIA (170 X 40 MM)



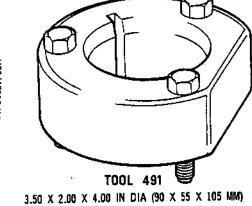
TOOL 42 4.75 X 4.00 X 0.75 IN DIA (125 X 105 X 20 MM)

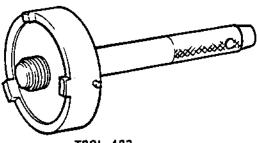


TOOL 665 4.50 X 0.50 IN DIA (115 X 15 MM)

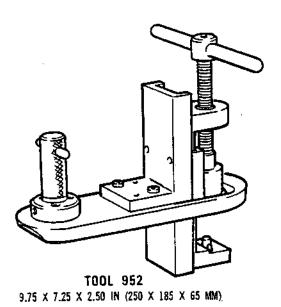
SPECIAL TOOLS ETC.

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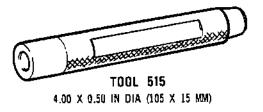


TOOL 492 5.25 X 2.50 IN DIA (135 X 65 MM)





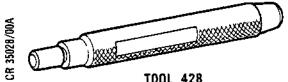
TOOL 429 4.00 X 0.50 IN DIA (105 X 15 MM)



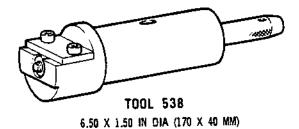


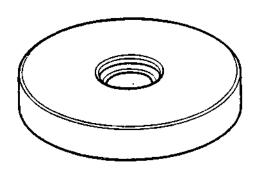
TOOL 539 4.50 X 0.50 IN DIA (115 X 15 MM)

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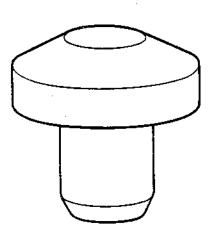


TOOL 428 4.50 X 0.50 IN DIA (115 X 15 MM)

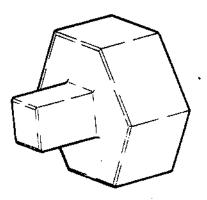




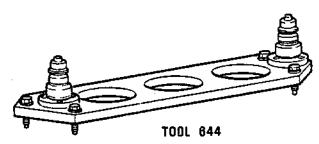
TOOL 709 0.75 X 5.00 IN DIA (20 X 130 MM)



TOOL 710 1.25 X 1.25 IN DIA (35 X 35 MM)



TOOL 1587
1.75 X 1.50 X 1.50 IN (45 X 40 X 40 MM)

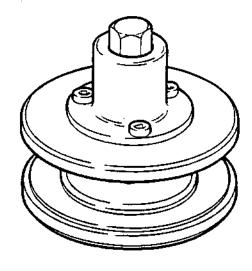


18.00 X 4.00 X 3.75 IN (460 X 105 X 100 MM)

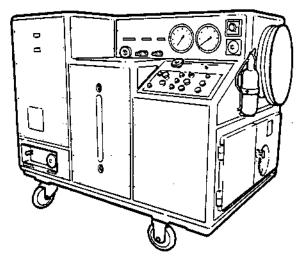
SPECIAL TOOLS ETC.

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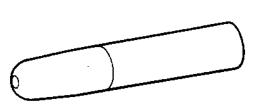
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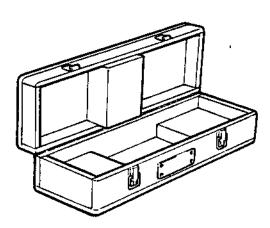
TOOL 997 3.75 X 4.00 IN DIA (100 X 105 MM)



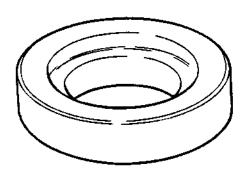
TOOL 1926 71.90 X 57.00 X 45.00 IN (1805 X 1450 X 1145 MM)



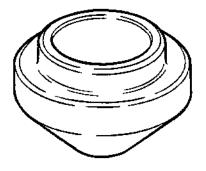
TOOL 513 1.75 X 0.50 IN DIA (45 X 15 MM)



TOOL 727 19.25 X 5.25 X 3.75 IN (490 X 135 X 100 MM)



TOOL 500 1.00 X 4.50 IN DIA (30 X 115 MM)

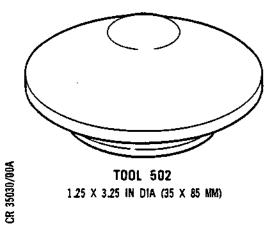


TOOL 501 2.00 X 3.00 IN DIA (55 X 80 MM)

SPECIAL TOOLS ETC.

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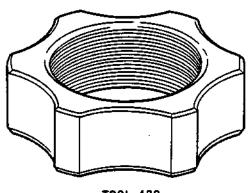
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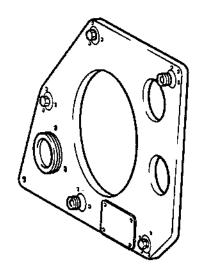
TOOL 502 1.25 X 3.25 IN DIA (35 X 85 MM)



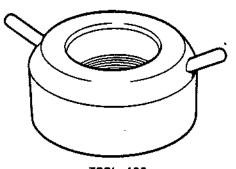
TOOL 37 14.00 X 2.00 IN DIA (360 X 55 MM)



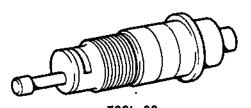
TOOL 498 0.50 X 2.00 IN DIA (15 X 55 MM)



TOOL 3077 18.00 X 13.50 X 3.50 IN (460 X 345 X 90 MM)



TOOL 495 4.25 X 1.75 X 3.00 IN DIA (110 X 45 X 80 MM)



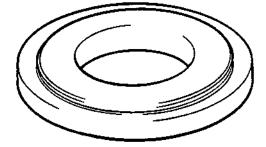
TOOL 38 8.00 X 2.00 IN DIA (205 X 55 MM)

SPECIAL TOOLS ETC.

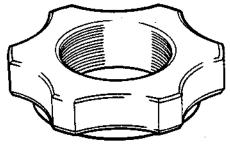
Page 1031 Nov 1/78



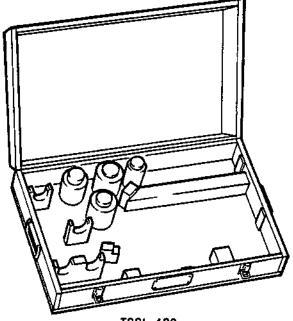




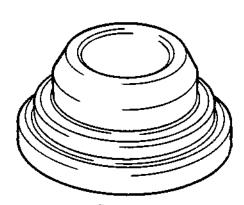
TOOL 496 0.50 X 3.00 IN DIA (15 X 80 MM)



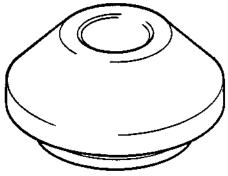
TOOL 497 0.75 x 2.75 IN DIA (20 X 70 MM)



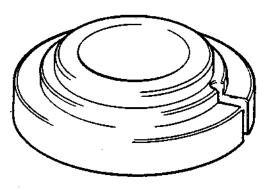
TOOL 499 25.75 X 16.25 X 4.75 (N (655 X 415 X 125 MM)



TOOL 483 2.25 X 4.50 IN DIA (60 X 115 MM)



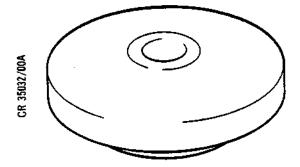
TOOL 490 1.00 X 2.00 IN DIA (30 X 55 MM)



TOOL 503-1.50 X 4.50 IN DIA (40 X 115 MM)

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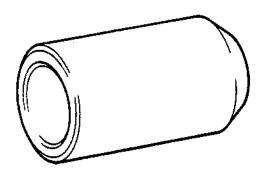




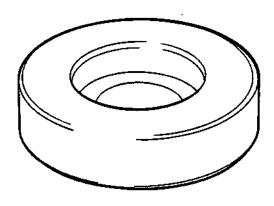
TOOL 504 1.00 X 3.00 IN DIA (30 X 80 MM)



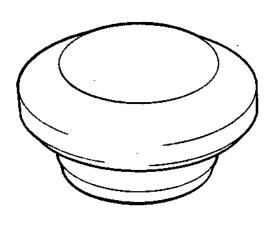
TOOL 672 1.25 X 3.50 IN DIA (35 X 90 MM)



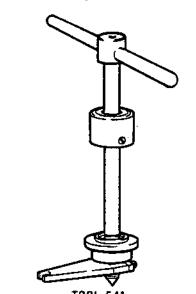
TOOL 671 2.50 X 1.50 IN DIA (65 X 40 MM)



TOOL 529
1.00 X 4.00 IN DIA (30 X 105 MM)



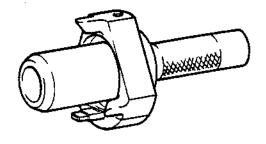
TOOL 530 0.75 X 1.50 IN DIA (20 X 40 MM)



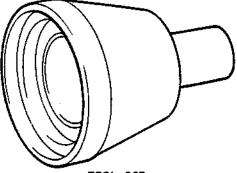
TOOL 541 12.00 X 10.00 IN DIA (305 X 255 MM)

SPECIAL TOOLS ETC.

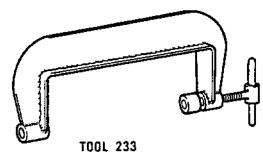
72-63-00 Page 1033 Nov 1/78



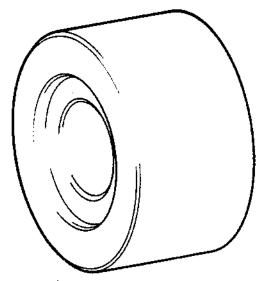
TOOL 866 6.25 X 3.00 IN DIA (160 X 80 MM)



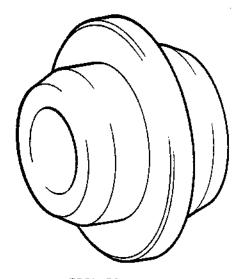
TOOL 667 3.00 X 2.50 IN DIA (80 X 65 MM)



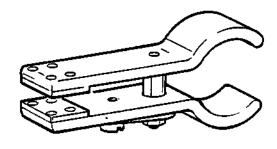
28.25 X 13.90 X 2.90 IN (720 X 335 X 55 MM)



TOOL 533 2.25 X 4.00 IN DIA (60 X 105 MM)



TOOL 534 1.25 X 1.75 IN DIA (35 X 45 MM)



TOOL 965 5.75 X 2.25 X 1.25 IN (150 X 60 X 35 MM)

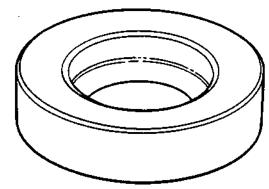
SPECIAL TOOLS ETC.

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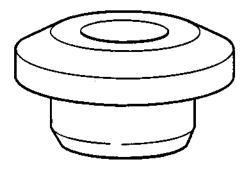




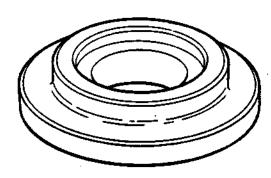
CR 35034/00A



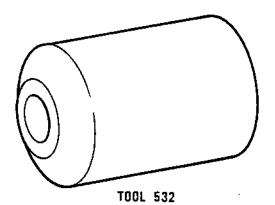
TOOL 648 1.00 X 4.50 IN DIA (30 X 115 MM)



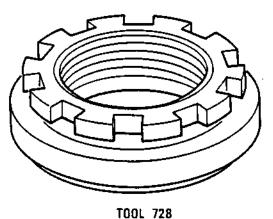
TGOL 649 0.75 X 1.50 IN DIA (20 X 40 MM)



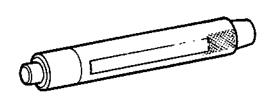
TOOL 531 1,00 X 4.00 IN DIA (30 X 105 MM)



3.00 X 2.00 IN DIA (80 X 55 MM)



1.00 X 2.50 IN DIA (30 X 65 MM)

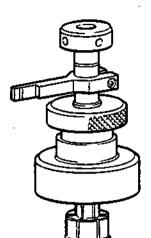


TOOL 766 4.50 X 0.50 IN DIA (115 X 15 MM)

SPECIAL TOOLS ETC.

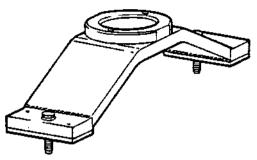
72-63-00

Page 1035 Nov 1/78

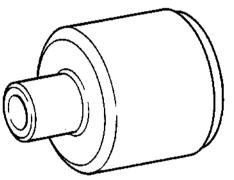


CR 35035/00A

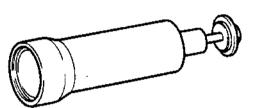
TOOL 7147.25 X 4.00 X 3.00 IN (185 X 105 X 80 MM)



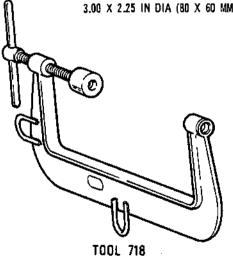
TOOL 719 13.00 X 3.75 X 3.25 IN (335 X 100 X 85 MM)



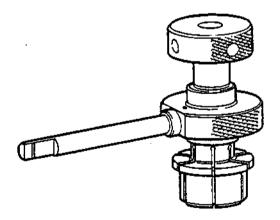
TOOL 720 3,00 x 2,25 IN DIA (80 X 60 MM)



TOOL 721 8.00 X 2.25 IN DIA (205 X 60 MM)



32.25 X 17.75 X 1.75 IN (820 X 455 X 45 MM)



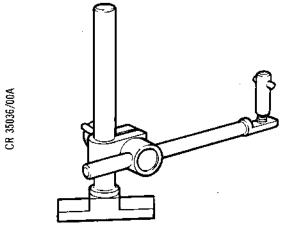
TOOL 711 5.75 X 4.00 X 2.00 IN (150 X 105 X 55 MM)

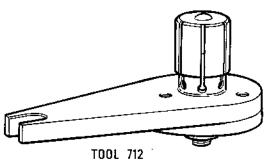
Right-hand Accessory Gearbox - Special Tools Figure 1026

SPECIAL TOOLS ETC.

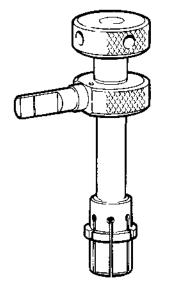
72-63-00 Page 1036 Nov 1/78



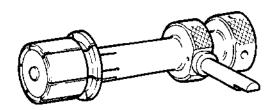




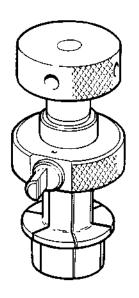
4,50 X 2.00 X 2.00 IN (115 X 55 X 55 MM)



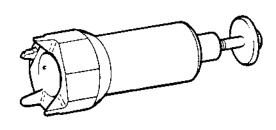
TOOL 713 4.75 X 2.50 X 1.25 IN (125 X 65 X 35 MM)



\$T00L\$ 726 6.50 x 4.00 x 1.75 IN (170 x 105 x 45 MM)



TOOL 725 4.25 X 3.00 X 2.00 IN (110 X 80 X 55 MM)



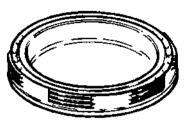
TOOL 786 8.00 X 2.50 IN DIA (205 X 65 MM)

SPECIAL TOOLS ETC.

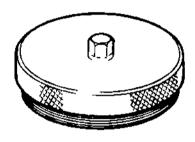
Page 1037 Nov 1/78



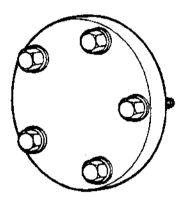
TOOL 1708 6.00 X 0.75 X 0.50 IN (155 X 20 X 15 MM)



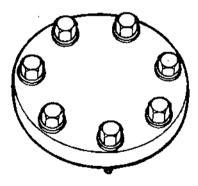
TOOL 740 1.50 X 10.50 IN DIA (40 X 270 MM)



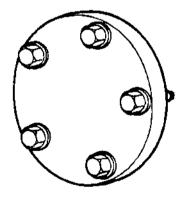
TOOL 722 2.00 X 6.00 IN DIA (55 X 155 MM)



TOOL 771 1.50 X 2.75 IN DIA (40 X 70 MM)



TOOL 772 1.50 X 3.25 IN DIA (40 X 85 MM)

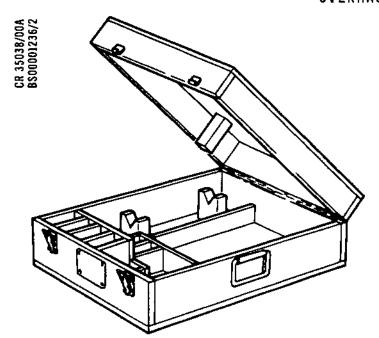


TOOL 773 1.50 X 2.50 IN DIA (40 X 65 MM)

SPECIAL TOOLS ETC.

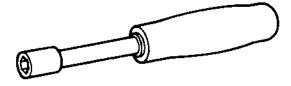
Page 1038 Sep 30/94



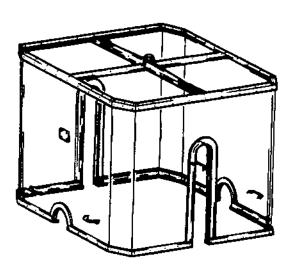


TOOL 791 19.50 X 18.00 X 6.00 IN (500 X 460 X 155 MM)

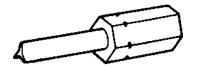
TOOL 789 2.00 X 1.75 IN DIA (55 X 45 MM)



TOOL 1912 7.50 X 1.00 IN (195 X 30 MM)



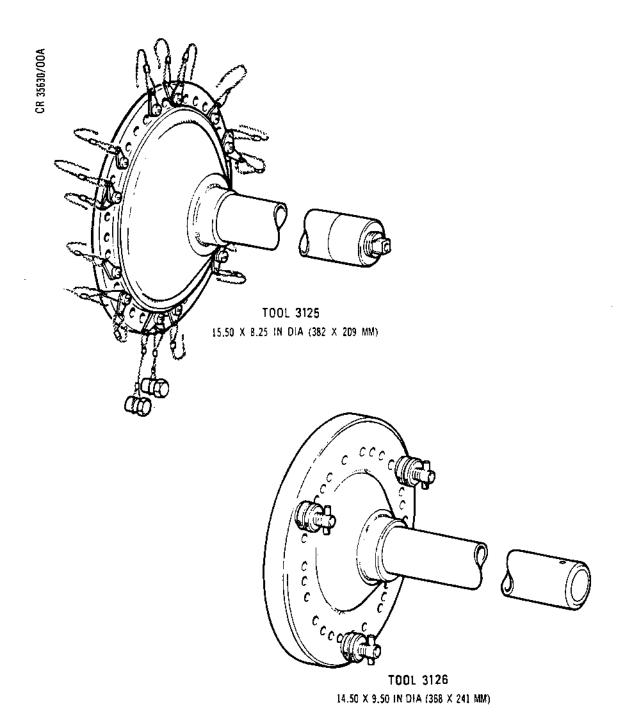
TOOL 797 47.25 X 43.75 X 37.50 IN (1205 X 1115 X 955 MM)



TOOL 1911 1.75 X 0.75 IN (45 X 20 MM)

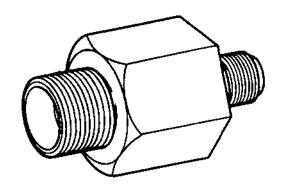
72-63-00
Page 1039
Dec 30/98



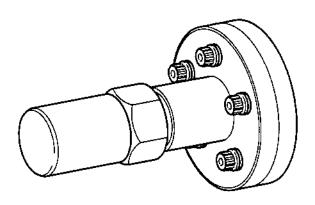


SPECIAL TOOLS ETC.

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TOOL 790 2.50 X 1.50 DIA (65 X 40 MM)



TOOL 3151

Right-hand Accessory Gearbox - Special Tools Figure 1031

SPECIAL TOOLS ETC.

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MAIN OIL PUMP - SPECIAL TOOLS, FIXTURES AND EQUIPMENT

General

- A. The special tools, fixtures and equipment listed in Table 1001 and 1002 are those required to disassemble and assemble the main oil pump assembly.
- B. The tools have been listed in order of usage, and the Tool Ref. No. is the number quoted in the text. Tools marked with an * are used in more than one aspect of overhaul, and will be duplicated in the tables.
- C. The tools are illustrated in order of usage, but tools used in more than one aspect of overhaul will only be illustrated once. Additional illustrations of tooling in operation (as thought necessary), are included in the text in the appropriate section.

2. Main Oil Pump Disassembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|-----------------|--------------------------|--|------|
| 869 | PJ.1212125 | Protector, pressure pump case | 1001 |
| *852 | P3C.1212126 | Holding fixture, pressure pump | |
| | | case | 1001 |
| 123 | P3C.1063671 | Protector, mounting face, oil feed | 1001 |
| 122 | P3C.1063670 | Protector, mounting face, oil feed | |
| | | from tank/scavenge | 1001 |
| 124 | P3C.1063672 | Protector, mounting face, oil coooler return | 1001 |
| 121 | P3C.1063669 | Protector, mounting face, oil scavenge | 1001 |
| 120 | P3C.1063668 | Protector, mounting face, oil | |
| | | scavenge | 1002 |
| 282 | P3C.1073104 | Protector, mounting face, oil | |
| | | scavenge | 1002 |
| *1478 | P3C.1063673 | Spanner wrench, filter retaining ring | 1002 |
| *1579 | P3C.1229389 | Crowfoot wrench, relief valve cap | 1002 |
| | | (pre-SB.72-8) | 1002 |
| *1972 | P3C.1262635 | Crowfoot wrench, relief valve cap | |
| | | (SB.72-8) | 1002 |

Disassembly Tools
Table 1001 (Continued)

SPECIAL TOOLS ETC.

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| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|---------------------------------------|-------------|
| *1593 | P3C.697245 | Adjuster tool, relief valve | 1003 |
| 333 | P3C.1076069 | Locator, puller (129) | 1003 |
| 129 | P3C.1065008 | Mechanical puller, relief valve | |
| | | guide | 1003 |
| *1021 | P3C.624598 | Mechanical puller, pump cases | 1003 |
| *1479 | P3C.1065013 | Driver, sediment strainer | 1004 |
| * 132 | P3C.1065012 | Vice holder, sediment strainer | 1004 |
| *1969 | P5J.1244703 | Tommy bar, strainer sleeve | 1004 |
| * 119 | P3C.1063667 | Protector, No.4 scavenge pump case | 1004 |
| * 126 | P3C.1065004 | Protector, No.5 scavenge pump case | 1004 |
| * 125 | P3C.1065003 | Protector, No.2/3 scavenge pump case | 1005 |
| * 127 | P3C.1065005 | Protector, No.1 scavenge pump case | 1005 |
| 1463 | P3C.868992 | Container, scavenge pump cases | 1005 |
| 1470 | P30.868993 | Container, pump gears | 1005 |
| 1471 | P3C.868994 | Container, pressure pump cases | 1005 |
| *3155 | \$3\$20558000 | Adaptor set, torque | 1003 |

Disassembly Tools Table 1001 (Concluded)

3. Main Oil Pump Assembly Tools

| TOOL REF.NO. | MANUFACTURER PART NO. | DESCRIPTION | FIG. NO. |
|-----------------|--------------------------|------------------------------------|-------------|
| 857 | P30.1212153 | Holding fixture, pump cases | 1006 |
| * 126 | P3C.1065004 | Protector, No.5 scavenge pump | |
| | | case | 1004 |
| * 127 | P3C.1065005 | Protector, No.1 scavenge pump | |
| | | case | 1005 |
| 128 | P3C.1065006 | Driver, hollow pins (pre-SB.72-18) | 1006 |

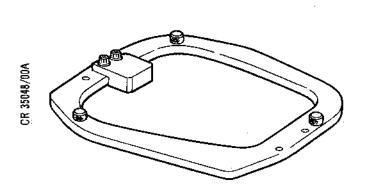
Assembly Tools Table 1002 (Continued)

SPECIAL TOOLS ETC.

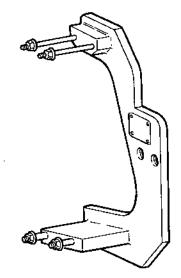
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| | MANUFACTURER PART NO. | DESCRIPTION | FIG. |
|---------------|--------------------------|------------------------------------|------|
| 1971 | P3C.1288058 | Driver, hollow pins (SB.72-18) | 1006 |
| 112 | P3C.1063657 | Holding fixture, pump cases | 1006 |
| 4 | P3C.1063660 | Alignment pin, pump cases | 1006 |
| 114 | P3C.1063661 | Container, alignment pin (4) | 1006 |
| 117 | P3C.1063664 | Spacer sleeve, pump assembly | 1007 |
| 3 | P3C.1063659 | Alignment pin, pump cases | 1007 |
| *1021 | P3C.624598 | Mechanical puller, pump cases | 1003 |
| * 119 | P30.1063667 | Protector, No.4 scavenge pump case | 1004 |
| * 125 | P3C.1065003 | Protector, No.2/3 scavenge pump | |
| | | case | 1005 |
| 115 | P3C.1063662 | Spacer sleeve, pump assembly | 1007 |
| 118 | P3C.1063665 | Spindle, slave, gears | 1007 |
| 338 | P3C.1076086 | Container, slave spindle (118) | 1007 |
| 111 | P3C.1063656 | Spacer sleeve, pump assembly | 1008 |
| 116 | P3C.1063663 | Spacer sleeve, pump assembly | 1008 |
| * 852 | P3C.1212126 | Holding fixture, pressure pump | |
| | | case | 1001 |
| 131 | P3C.1065011 | Turning key, gears | 1008 |
| * 132 | P3C.1065012 | Vice holder, sediment strainer | 1004 |
| *1969 | P3C.1244703 | Tommy bar, sediment strainer jet | 1004 |
| *1479 | P3C.1065013 | Driver, sediment strainer | 1004 |
| 1970 *1593 | P3C.1065019 | Drift, relief valve assembly | 1008 |
| *1393 | P3C.697245 | Adjuster tool, relief valve sleeve | 1003 |
| *1579 | P3C.2229389 | Crowfoot wrench, relief valve | 1003 |
| 71217 | F30.2227367 | cap (pre-SB.72-8) | 1002 |
| *1972 | P3C.1262635 | Crowfoot wrench, relief valve | 1002 |
| 71712 | 1 30.1202033 | cap (SB.72-8) | 1002 |
| *1478 | P3C.1063673 | Spanner wrench, filter retaining | 1002 |
| / / | . 5011005015 | ring | 1002 |
| *3155 | S3S20558000 | Adaptor set, torque | 1003 |

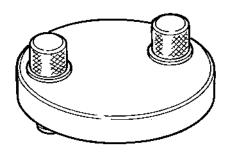
Assembly Tools Table 1002 (Concluded)



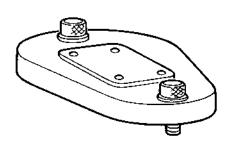
TOOL 869 11.75 X 11.50 X 1.25 IN (300 X 295 X 35 MM)



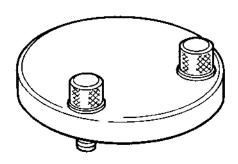
TOOL 852 13.00 X 7.75 X 4.75 IN (335 X 200 X 125 MM)



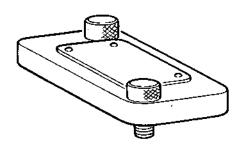
TOOL 123 1.25 X 2.75 IN DIA (35 X 70 MM)



TOOL 122 5.00 X 2.75 X 1.25 IN (130 X 70 X 35 MM)



TOOL 124 1.25 X 3.25 IN DIA (35 X 85 MM)



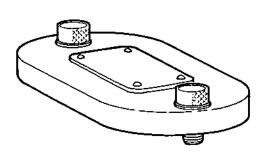
TOOL 121 3.75 X 2.00 X 1.25 IN (100 X 55 X 35 MM)

Main Oil Pump - Special Tools Figure 1001

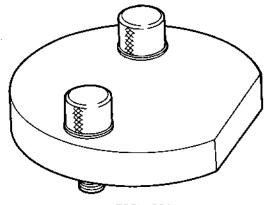
SPECIAL TOOLS ETC.

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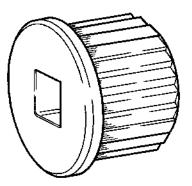
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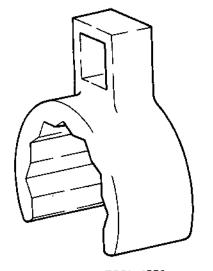
TOOL 120 5.00 X 2.75 X 1.25 IN (130 X 70 X 35 MM)



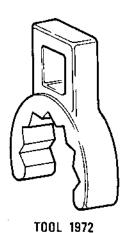
TOOL 282 1.25 X 2.75 IN DIA (35 X 70 MM)



TOOL 1478 1.25 X 1.75 IN DIA (35 X 45 MM)



TOOL 1579 2.25 X 2.00 X 1.00 IN (60 X 55 X 30 MM)



2.00 X 1.00 X 0.50 IN (55 X 30 X 15 MM)

Main Oil Pump - Special Tools Figure 1002

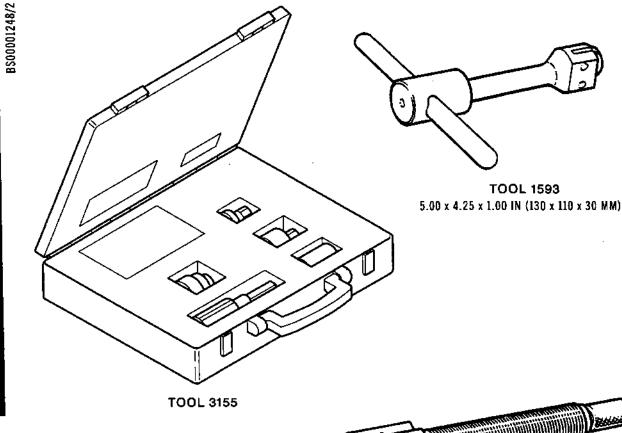
SPECIAL TOOLS ETC.

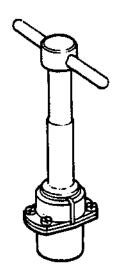
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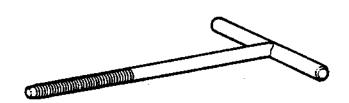
MK.610-14-28 Overhaul





TOOL 129 8.75 X 6.75 X 1.50 IN DIA (225 X 175 X 40 MM)





TOOL 1021 6.00 X 3.75 X 0.25 IN DIA (155 X 100 X 10 MM)

Main Oil Pump - Special Tools Figure 1003

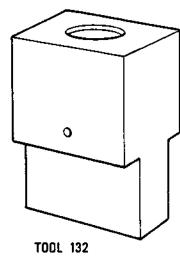
SPECIAL TOOLS ETC

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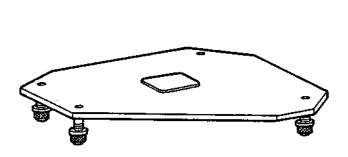
TGGL 1479 5.00 X 0.50 IN DIA (130 X 15 MM)



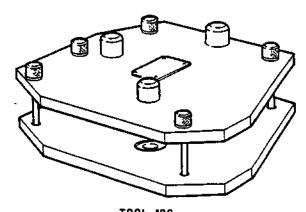
3.00 X 2.00 X 1.50 IN (80 X 55 X 40 MM)



TOOL 1969 5.50 X 0.50 IN DIA (140 X 15 MM)



TOOL 119 9.25 X 8.50 X 1.50 IN (235 X 220 X 40 MM)



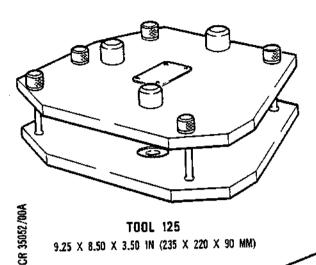
TOOL 128 9.25 X 8.50 X 3.00 IN (235 X 220 X 80 MM)

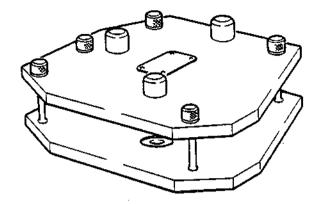
Main Oil Pump - Special Tools Figure 1004

SPECIAL TOOLS ETC.

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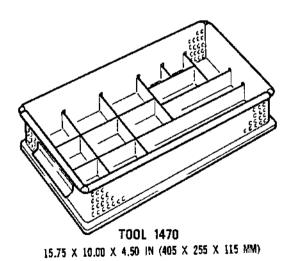


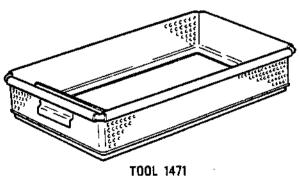


TOOL 125 9.25 X 8.50 X 3.50 IN (235 X 220 X 90 MM)

TOOL 127 9.25 X 8.50 X 2.75 IN (235 X 220 X 70 MM)

TOOL 1463 15.75 X 10.50 X 10.25 IN (405 X 270 X 265 MM)





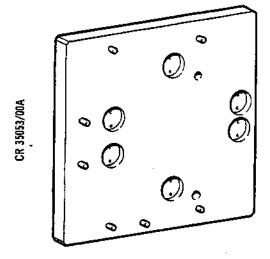
22.00 X 15.75 X 4.75 IN (560 X 405 X 125 MM)

Main Oil Pump - Special Tools Figure 1005

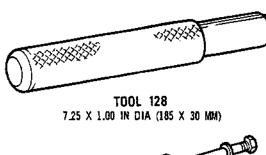
SPECIAL TOOLS ETC. Page 1008 Nov 1/78

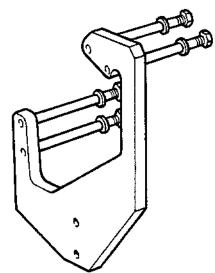




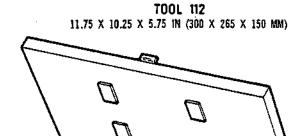


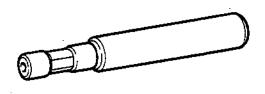
TOOL 857 9.50 X 9.00 X 1.50 IN (245 X 230 X 40 MM)



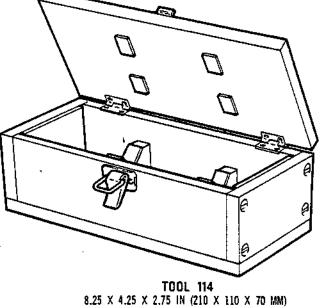


TOOL 1971 7.25 X 1.00 IN DIA (185 X 30 MM)





TOOL 4 7.25 X 1.00 IN DIA (185 X 30 MM)

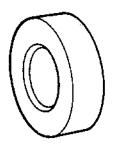


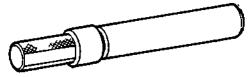
Main Oil Pump - Special Tools Figure 1006

SPECIAL TOOLS ETC.

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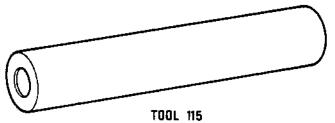




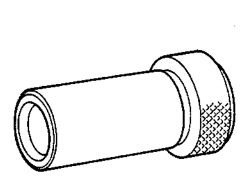


TOOL 3 7.25 X 1.00 IN DIA (185 X 30 MM)

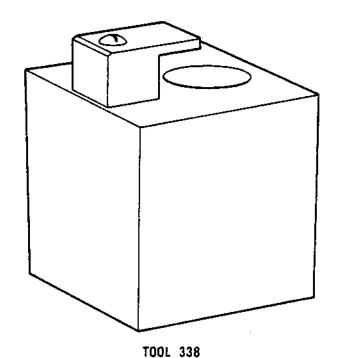
TOOL 117 0.25 X 0.75 IN DIA (10 X 20 MM)



4,00 X 0.75 IN DIA (105 X 20 MM)



TOOL 118 2.50 X 1.25 IN DIA (65 X 35 MM)



3,25 X 2.25 X 2.25 IN (85 X 60 X 60 MM)

Main Oil Pump - Special Tools Figure 1007

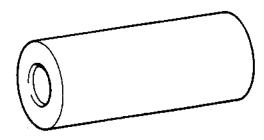
SPECIAL TOOLS ETC.

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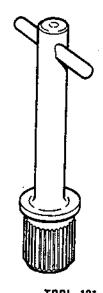


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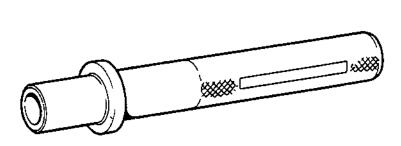
TOOL 111 1.00 X 0.75 IN DIA (30 X 20 MM)



TOOL 116 1.75 X 0.75 IN DIA (45 X 20 MM)



TOOL 137 4.50 X 2.50 X 1.00 IN DIA (115 X 65 X 30 MM)



TOOL 1970 6.50 X 1.25 IN DIA (170 X 35 MM)

Main Oil Pump - Special Tools Figure 1008

SPECIAL TOOLS ETC.

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GENERAL - ENGINE TESTING

1. Introduction

- A. The testing of the Olympus engine as detailed in this manual consists of five sections in sequential order. Refer to paragraph 3 following, for information contained in the sections.
- B. A comprehensive knowledge of how and why the engine operates is a fundamenal prerequisite for the efficient, intelligent and safe testing of the engine.

General

- A. All safety precautions and warnings are to be brought to the attention of all personnel concerned with engine testing or test cell procedures. Refer to paragraph 4 for safety precautions and warnings.
- B. Throughout the text in the testing section, special tools are quoted by their Ref.No. e.g. (Tool 1234). For a complete list of tooling required for engine testing and also for Manufacturers Part No., refer to Special Tools, Fixtures and Equipment, Table 1001.
- C. Consumable materials used in Testing are quoted in the text by nomenclature and followed by a letter, e.g. lubricant B. Refer to Table 701 for list of consumables.
- D. Symbols and abbreviations used throughout testing should be adhered to whenever possible to avoid confusion when transmitting or interpreting data. Refer to Table 702.
- E. Basic engine leading particulars are listed in the text (Ref.para.6.).



| Nomenclature | Item | Specification | Approved Brands |
|---------------------|------------|--|---|
| ubricant | A . | DERD 2497 (issue 3) | Esso ETO 25 Mobil RM.193A-3 Shell Asto 555 (Shell ASTO 555 USA blended must be marked DERD 2479 on the can) Royco Turbine Oil 555 |
| | В | DTD 8068 | AeroSheil grease |
| | S | AIR 4247 (D.T.D.900/ 3928) | AeroShell Compound 08 Total 4247 Nyco GA47 |
| uel | | D.Eng.RD.2494 (issue 7) or AIR 3405/C (issue 4) | Shell Jet A-1 |
| Anti-seize Compound | A | | Neverseize CM 145 |
| | 9 | HF-825 | Acriloid |
| Inhibiting Fluid | A | D.E.F. STAN 91-44/1 (previously D.E.F. 2001A) | AeroShell Fluid 1 |
| | | D.E.R.D. 2490 | AeroShell Turbine Oil 3 |
| | · | AIR 3515/B | AeroShell Turbine Oil 3 |
| | | AIR 3516/A | Esso Turbo Oil 10 |

Consumable Materials Table 701 (Continued)

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| Nomenclature | Item | Specification | Approved | Brands |
|------------------|---------|-------------------|----------|---------|
| Matariala | · | | · | <u></u> |
| <u>Materials</u> | Locking | Nimonic 90, | | |
| | wire | MSRR 7015 | | |
| | 0,8 mm | Inconel 600, | | |
| | | ASM 5687 | | |
| · | White | BS 245 | Stoddart | solvent |
| | spirit | | | |
| | Filter | P300 - 125 micron | | |
| | papers | (18 in. dia | | |
| | | 457 mm) | | |

Consumable Materials Table 701 (Concluded)



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| Symbol or Abbreviation | Defin | Ltion | Measurement |
|--|--|----------------|-------------|
| NOTE: Liqui unles | d measure throughout texts otherwise stated. | is in Imperial | measurement |
| A | Ampere | • | Unit |
| AC | Alternating current | | Volts |
| ALT | Alternate | | _ |
| Aj | Primary nozzle area | | in. mm |
| BSP | British standard pipe (t | hread gauge) | _ |
| $\frac{(\underline{dx})}{(\underline{x})}$ | Detuner suction and entradded together | ainment drag | |
| E (Schedule) | Engine control schedule | | _ |
| EGT | Exhaust gas temperature | | đeg C |
| f | Function of | | _ |
| Fe | Fuel flow, main engine s | ystem | lb/h |
| Fr | Fuel flow, reheat system | ı | lb/h |
| $^{\mathrm{F}}\mathrm{r}$ | Fuel flow, total (engine | and reheat) | lb/h |
| gal | Gallon | | Unit |
| h | Hour | | Unit |
| Нд | Mercury | | in. |
| HP (N ₂) | High pressure compressor | shaft speed | rpm |
| HZ | Hertz (frequency) | | s |
| IDG | Integrated drive generat | or | - |
| | | | |

Symbols and Abbreviations Table 702 (Continued)

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| Symbol or Abbreviation | Definition | Measurement |
|---------------------------|-------------------------------------|-------------|
| K | Kelvin (temperature) | Unit |
| Kg or kg | Kilogram | Unit |
| lb | Pound | Unit |
| lbf | Pound force (torque) | Unit |
| LH | Left-hand | - |
| LP (N _l) | Low pressure compressor shaft speed | rpm |
| mm | Millimetre | Unit |
| N.m | Newton metre (torque) | Unit |
| P | Pressure | - |
| Perklone | Perchloraethylene | - . |
| P cell | Test cell pressure | in Perklone |
| PNC | Primary nozzle control | _ |
| psi(g) | Pounds per square inch (gauge) | Unit |
| PV | Air intake static pressure | in Perklone |
| P1 | Engine air inlet pressure | in. Hg |
| ₽7 | Jet pipe pressure | psi |
| QAD | Quick attach detach coupling | _ |
| RH | Right-hand | - |
| rpm | Revolutions per minute | Unit |
| S | Second | Unit |

Table 702 (Continued)

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| Symbol or Abbreviation | Definition | Measurement |
|---------------------------|--|-------------|
| SFC | Specific fuel consumption | gal/h |
| SG | Specific gravity | Unit |
| SHT | Sheet | |
| S/L | Sea level | - . |
| sov | Shut-off valve . | _ |
| T · | Temperature | deg C |
| та | Temperature, ambient | deg C |
| то | Take-off (power rating) | _ |
| Тj | Jet pipe temperature (EGT) | deg C |
| T ₁ | Temperature, air inlet | deg C |
| UNF | Unified national fine (thread gauge) | - |
| UNJF | Unified national fine, (close tolerance) | - |
| US quarts | Quarts, United States measurement | Unit |
| v | Volts | Unit |
| +VE | Positive (electrical) | - |
| W | Mass flow | lb/s |
| x | Thrust | lb |
| θ (Theta) | T ₁ deg K | |
| | 288 | |

Symbols and Abbreviations (Table 702 (Concluded)



3. Testing Section Breakdown

A. General.

The testing section is in five sections with a sixth section containing information required for trouble shooting. The trouble shooting section also contains the necessary information for the removal and installation of suspect components.

B. Breakdown.

The information contained in each section is as follows:

- (1) Equipment and Set-up Section (72-00-25).
 - (a) Details of special test equipment required.
 - (b) Installation of slave accessories.
 - (c) Removal of slave accessories.
 - (d) Installation of engine in test cell.
 - (e) Removal of engine from test cell.
 - (f) Test cell electrical hook-up requirements.
- (2) Procedures and Adjustments Section (72-00-26).
 - (a) Servicing of engine oil systems.
 - (b) Static checks of engine system.
 - (c) Engine adjustments.
- (3) Engine Test Schedule and Checks Section (72-00-27).
 - (a) Checks required during engine test run.
 - (b) Test schedule checking list.
 - (c) Performance check.
 - (d) Proof run and handling checks.
 - (e) Fuel system inhibiting.
 - (f) Preparation and despatch from test cell.

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- (g) Test requirements following module changes.
- (4) Schedule for Proof Test Procedure after Minor Rectification Section (72-00-28).
 - (a) Proof test.
 - (b) Fuel system inhibiting.
- (5) Specification and Analysis Section (72-00-29).
 - (a) Operating limitations.
 - (b) Performance acceptance standards.
 - (c) Performance correction factors.
 - (d) Accessory loadings.
 - (e) Compressor bleeds.
- (6) Trouble Shooting Section (72-00-35) (To be issued later).
 - (a) Trouble shooting (page block 801).
 - (b) Removal of components (page block 101).
 - (c) Installation of components (page block 501).

Safety Precautions and Warnings

- A. The following safety precautions are to be brought to the attention of all personnel concerned with engine testing.
 - (1) A notice is to be placed in a prominent position in the control room and near the jet pipe stating the type of fuel being used.
 - (2) A period of 10 minutes after running on AVTUR and 20 minutes after running on AVTAG and AVCAT are to elapse prior to personnel being allowed near the jet pipe nozzle.
 - (3) If on snut-down, an internal fire is suspected, it must be definitely extinguished before commencing the timing of the danger period.
 - (4) Extinguish internal fires by carrying out a dry motoring cycle with the HP valve closed.

B. The following WARNINGS are to be brought to the attention of all personnel concerned with engine testing.

WARNING: HIGH ENER ELECTRICA DISCHARGE

HIGH ENERGY IGNITION EQUIPMENT GIVES CONSIDERABLE ELECTRICAL ENERGY DISSIPATION AT THE MOMENT OF DISCHARGE AND AN ACCIDENTAL ELECTRICAL SHOCK MAY PROVE FATAL. THEREFORE BEFORE COMMENCING WORK ON, OR IN THE VICINITY OF THE HIGH ENERGY SYSTEM, FIRST MAKE ABSOLUTELY SURE THAT THE IGNITION MASTER SWITCH ON THE CONTROL DESK IS SELECTED 'OFF', REMOVE INPUT FUSE THEN WAIT ONE MINUTE.

WARNING:

WHEN CHECKS AND ADJUSTMENTS NECESSITATE AN OPERATOR ENTERING THE TEST CELL WHILE THE ENGINE IS RUNNING. ALWAYS OBSERVE THE FOLLOWING PRECAUTIONS:

WEAR AN APPROVED TYPE EAR PROTECTOR.

ASCERTAIN THAT THE IGNITION MASTER SWITCH IS SELECTED 'OFF' BEFORE THE OPERATOR ENTERS THE TEST CELL.

MAINTAIN STRICT SURVEILLANCE FROM THE CONTROL ROOM WINDOW.

DO NOT ADVANCE THE CONTROL LEVER BEYOND THE IDLING POSITION UNTIL THE OPERATOR IS CLEAR OF THE TEST CELL.

5. Approved Fuel and Oils

- A. General.
 - (1) The fuels and oils listed hereunder are those approved by Rolls-Royce plc/SNECMA for the Olympus 593 dealt with in this Manual.
 - (2) Fuels to D.Eng.R.D. and AIR specifications are the primary fuels. Whilst all other fuel specifications listed have been proved by long service to be satisfactory, certain of them deviate from the relevant D.Eng.R.D. or AIR specification in that constituents are omitted or greater limits allowed. Protracted use of a fuel deviating from the relevant D.Eng.R.D. or AIR specification may have adverse affects for which Rolls-Royce plc/SNECMA cannot be held responsible.

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- (3) Should an operator wish to employ fuels and oils other than those listed, the approval and agreement of Rolls-Royce plc, must first be obtained.
- B. Approved Fuels.

Type

<u>Specification</u>

Aviation turbine kerosene type (AVTUR) D.Eng.R.D.2494 (issue 7) AIR 3405

C. Approved Oils.

The following oils to D.Eng.R.D.2497 are approved for use:

(1) In the Engine, Air Starter and Primary Nozzle Control Trim Unit:

ESSO ETO.25 MOBIL RM 193A-3 SHELL ASTO 555 ROYCO TURBINE OIL 555

NOTE: The engine and air starter oil systems interconnect, therefore the same brand of oil must be used for both units and any change of oil brand will necessitate flushing of both units as well as refilling with the new brand.

(2) In the Integral Drive Generator use:

ESSO ENCO 2380

D. Engine and Reheat Fuel System Inhibiting.

Type

<u>Specification</u>

Aviation turbine oil (3 centistokes viscosity).

D.E.F. STAN 91-44/1 (previously D.E.F. 2001A)

D.E.R.D. 2490

AIR 3515/B

AIR 3516/A

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6. Basic Engine Leading Particulars

| Туре | of Engine | | Straight flow, twin spool, turbojet. |
|-------|---|------------|--|
| Arrai | ngement | | Axial, compound. |
| Rotat | tion | | |
| | LP and HP systems | | Both anti-clockwise viewed from rear. |
| | Mounting systems | | Two main thrust trunnions situated each side of delivery casing. Two load brackets on top of delivery casing. Support links on top of engine at joint between AIT casing and LP compressor casing. |
| Dimer | nsions | | - |
| | Maximum diameter | | 159 in. 4038 mm 49 in. 1244 mm 47.75 1212 mm |
| Weigh | nt | | |
| | Bare engine, dry, inclusive of mountings, fuel and oil syste and oil tank, but excluding exhaust system. | ems, | 6550 lb - 2970 Kg |
| | Part dressed engine, as above but including reheat spray ring and reheat control units | | 6700 lb - 3030 Kg |
| | Fully dressed engine ready for installation in aircraft. As above but including, air star IDG, alternator, 2 hydraulic pumps and cabin air valve. | s rter, | 7000 lb - 3170 Kg |
| Bear | ing Identification | | |
| | Number 1 | | LP Compressor, front. LP Compressor, thrust. HP Compressor, thrust. HP Turbine. LP Turbine. |

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Compressors

| - | | | | | | | |
|-------|------------|--------------|-----------------|---------|---------|-------|---|
| | LP HP | ••• | • • • | | ••• | | 7 stage, axial flow 7 stage, axial flow |
| Comb | ıstion | n syste | em | ٠ | • | | |
| | | | | | | | Annular, vaporizing with sixteen double vaporizing tubes and two starting primers |
| Turb | ines | | | | | | |
| | LP | ••• | ••• | ••• | ••• | • • • | Single stage, axial flow |
| | HP | ••• | ••• | ••• | ••• | ••• | Single stage, axial flow |
| Speed | d at 3 | 100 per | c cent | rpm | | • | |
| | | | • • • | | | | 6500 rpm 8530 rpm |
| Thru | st | | | | | | |
| | Nomi | nal dry | y thrus | st at 1 | Max TO | ••• | 31350 at ISA sea level static |
| | Nomi | nal we | t thrus | st at 1 | OT XAM | ••• | 37090 at ISA sea level static |
| Acces | ssory | gearbo | ox driv | e rat | ios | | |
| RH g | earbo | x drive | en from | n HP s | ystem | | |
| | | t shaft | | | • • • | | 1.820 HP speed |
| | | | d IDG d pump | | | • • • | O.805 HP speed O.4355 HP speed |
| LH g | - earbo | x drive | en from | n HP s | ystem | | |
| | _ | | t | • • • | | • • • | 1.820 HP speed |
| | | pump pump | | • • • | • • • | | O.480 HP speed 1.414 HP speed |
| | | contro | | • • • | ••• | • • • | 0.526 HP speed |
| Inte | rmedia | ate cas | sing sı | ımp dr | iven fi | rom L | P system |

Speed probe shaft...

1.977 LP speed



EQUIPMENT AND SET-UP - ENGINE TESTING

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EQUIPMENT AND SET-UP - ENGINE TESTING

1. General

- This section details the installation of an engine in the test cell, including the instrumentation and associated slave equipment and components required to perform a test run, and the removal after test.
- Where quoted in the text of this section, special tools в. are indicated by their Ref. No. e.g. (Tool 1234). For a complete list of tooling required for engine testing and also for Manufacturers Part No., refer to Special Tools, Fixtures and Equipment, Table 1001. adapters and slave equipment peculiar to this section are in Tables 702 and 703. These items are quoted in the text of each section by both their specific table and item No. e.g. (Table 2, item 2).
- c. Consumables quoted in the text of this section are listed in Table 701, of section 72-00-24, Engine Testing - General, and are identified by their nomenclature and letter assigned, where appropriate, in the table, e.g. Apply lubricant 'B' to the threads.
- D. Instrumentation requirements for testing are listed in Tables 704 and 705.
- Electrical test cell requirements and electrical hook-up Ε. connections required for testing an engine are shown diagrammatically in Figure 713.
- F. Engine parts quoted in the text on assembly are identified by a full reference to the I.P.C. in parenthesis e.g. install bolt (72-63-01/8-10).
- The engine will be received for test on an overhead rail system or mounted on a transport stand. It is assumed that the test bed and facilities used conform to those recommended by Rolls-Royce Limited and that the test cell together with the instrumentation has been calibrated against an engine of known performance obtained at an approved test site. Appropriate correction factors can then be established, and any test results obtained by an operator must be factored accordingly.

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MK.610-14-28 snecma OVERHAUL

H. Prior to test it will be necessary to embody test bed changes to supply additional engine speed signals (N₁ and N₂) together with fuel manifold pressure signals (Ref. Table 704) to the DEVS signal conditioning equipment. For operation of the DEVS equipment refer to MJA Dynamics User Guide MJAD/R/64.6/92 and local procedures. Initially the No.1 bearing vibration pick up should be connected as normal to the vibrometer equipment.

| ITEM NO. | DESCRIPTION . | PART NO. |
|-------------|---|-------------|
| 1 | Primary nozzle control, type 950 | - |
| 2 | Primary nozzle trim unit, type NT951 or NT952 | - |
| 3 | Primary nozzle assembly | 301-217-000 |

Engine Test Components Table 701

| ITEM NO. | DESCRIPTION | PART NO. |
|-------------|---|---------------------------|
| 1 | Jet pipe - SNECMA type 10 or 14 (new or slave) with 6375 <u>+</u> 25 sq. cm maximum nozzle area | RL125397 |
| 2 | Air intake assembly - venturi type with 46.5 in. (1181 mm) diameter flare and air flow straightener | RL137278 or equivalent |
| 3 | Primary nozzle air control tubes set - for use between the engine and the primary nozzle control (PNC) and between the PNC and the primary nozzle | _ |
| 4 | Air starter shut-off valve | - |

Test Cell Adapter Set Table 702

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| ITEM NO. | DESCRIPTION | PART NO. |
|-------------|--|------------------------|
| 1 | Engine control amplifiers and open loop control | |
| | MAIN Lane ALTERNATE Lane | A6A14/24K A6A14/24K |
| 2 | LP governor amplifier | LSG103/3/D |
| 3 | Reheat control amplifier | R.V.884 |
| 4 | Slave S.E.M.C.A. air turbine starter | 1052 A02 |
| 5 | Oil tank pressure | |
| | Connection set comprised of the following: | |
| | Union nipple, 0.125 in. B.S.P. Cover | RS62290-A RS120895 |
| | Union body, 0.125 in. B.S.P. Union nut, 0.125 in. B.S.P. Bonded washer, 0.125 in. | RS62289-A RS62291-A |
| | B.S.P. | PP.45-A - Dowty |
| 6 | Engine oil pressure | |
| | Calibrated oil pressure) transmitter (range O to) Alternative 30 psi with 5% accuracy)) | s • |
| | Pressure test assembly) | \$3\$15265000 |

Engine Adapter Set Table 703 (Continued)

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| ITEM NO. | DESCRIPTION | PART NO. |
|-------------|---|-----------------------|
| 7 | Paragraph deleted. | |
| 8 | Exhaust annulus total pressure union nut 0.6875 in. 16 UNJS - 3B | AS15703 |
| 9 | Engine fuel inlet connection | RM110187 |
| 10 | Adapter - S.E.M.C.A. air turbine starter | RM115617 |
| 11 | Adapter - recirculation fuel connector | RS110100 |
| 12 | Exhaust annulus static pressure. Adapter connection comprises of the following: | |
| | Adapter Union body | B451842 B376203 |
| | Adapter connection to dummy transducer block: | |
| | Adapter Seals | B420285 AS12801-11 |

Engine Adapter Set Table 703 (Continued)

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| ITEM NO. | DESCRIPTION | PART NO. |
|-------------|---|----------------------|
| 13 | Turbine drain valve position indicator. Consists of a temperature sensing device secured to the exit opening of the turbine drain valve for determination of the opening of the valve by temperature change indication. | Local manufacture |
| 14 | Static pressure, anti-icing nut, 0.4375 in. 20 UNJF - 3B | AS15700 |
| 15 | Slave TRA elbow | RM118736 |

Engine Adapter Set Table 703 (Concluded)



ENGINE TAPPING POINT

Static pressure of LP turbine One Refer to Table 703,

NOTE: When the engine has flight instrumentation attached, connect to dummy transducer block using adapters.

PARAMETER TITLE - DESCRIPTION

Static pressure of anti-icing air. Live line connection to control room.

One Refer to Table 703 for engine adapter, item 14.

NO. OFF

Static pressure of oil tank. Slave tapping, live line to control room.

One Refer to
Table 703 for
engine adapter
set, item 5.

Engine oil pressure:

Slave pressure transmitter,)
cable to control room.

Slave tapping, live line
to gauge.

One

Refer to Table 703 for engine adapter set, item 6.

REMARKS

item 12.

Exhaust annulus total pressure. Pitot tapping, live line to control room.

Refer to Table 703 for engine adapter set, item 8.

Temperature of delivery at HP One compressor, thermocouple to thermocouple termination junction box, cable to control room.

One

Engine Test Instrumentation
Table 704 (Continued) (Sheet 1 - LH)

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CONTROL ROOM

| INDICATOR TYPE RANGE AND METHOD | LOCATION | NO. OFF |
|---|--------------------------------------|-----------------|
| Standard test gauge, Budenberg. 0-60 psig <u>+</u> 0.25 per cent. | Manometer panel | One |
| Gauge O to 50 psig <u>+</u> 2 per cent. ■ | Control panel | One |
| Standard test gauge, Budenberg. O to 5 psig <u>+</u> 1 per cent. | Pressure panel | One |
| Standard test gauge, O to 50 psig - Standard test gauge, | Pressure panel - Control panel | 0ne - 0ne |
| Budenberg. 0-60 psig ± 0.25 per cent. Temperature precision indicator, Honeywell Brown. 156 x 63 - PS(D) 48H-11-111-L-R. 0 to 500 deg C ± 1 deg C. | Temperature panel | One |

Engine Test Instrumentation
Table 704 (Continued) (Sheet 1 - RH)

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| | | |
|--|---|----------------------------------|
| ENGINE TAPPING POINT PARAMETER TITLE - DESCRIPTION | NO. OFF | REMARKS |
| Exhaust gas temperature, thermo- couples, cable connection to the thermocouple termination junction box. Cable to control room. | Three leads with eight thermo- couples each | |
| Number 12 labyrinth vent tem- perature, connection to the thermocouple termination junction box. Cable to control room. | One | |
| HP turbine cooling air tem- perature thermometer connection to the thermocouple termination junction box. Cable to control room | One | |
| Oil temperature oil pump inlet. Sangamo Weston resistance thermometer 130 electrical cable to control room. | One | Electrical harness plug G. |
| Oil temperature, HP turbine (No.4) bearing inlet, thermo-couple from oil inlet tube, electrical cable to control room. | One | Electrical harness plug D. |
| Oil temperature, HP turbine (No.4) bearing outlet, thermo-couple from oil outlet tube, electrical cable to control room. | One | Electrical harness plug D. |

Engine Test Instrumentation Table 704 (Continued) (Sheet 2 - LH)

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| CONTROL RO | ОМ | |
|---|------------------------|-----------------|
| INDICATOR TYPE RANGE AND METHOD | LOCATION | NO. OFF |
| Temperature precision indicator, Honeywell Brown. 156 X 63 - PS(D) 48H-11-111-L-R. O to 1200 deg C + 1 deg C. | Temperature panel | Select 1,2,3 |
| Temperature meter. Transitrol 1290. O to 800 deg C + 5 deg C. | Temperature panel | One |
| Temperature meter. Transitrol 1290 or 990. O to 800 deg ± 5 deg C. | Temperature panel | One |
| Temperature meter. Sangamo Weston 130. O to 200 deg + 2 deg C. | Temperature panel | One |
| Precision temperature indicator Honeywell Brown. O to 300 deg C + 1 deg C. | Temperature panel · | One |
| Precision temperature indicator Honeywell Brown. O to 300 deg C + 1 deg C. | Temperature panel | One |

Engine Test Instrumentation Table 704 (Continued) (Sheet 2 - RH)

| ENGINE TAPPING POINT PARAMETER TITLE - DESCRIPTION | NO. OFF | REMARKS |
|---|---------|----------------------------------|
| HP and LP turbine (No.4 and 5) bearings cold vent temperature, thermocouple in cold vent tube to the thermocouple termination junction box, electrical cable to control room. | One | |
| HP and LP compressor thrust (No.2 and 3) bearings cold vent temperature, thermocouple, to the thermocouple termination junction box. Cable to control room. | One | |
| LP turbine (No.5) bearing hot vent temperature, thermocouple, to the thermocouple termination junction box. Cable to control room. | One | · |
| Fuel temperature at turbo pump outlet. Rosemount resistance thermometer E.926.100 in fuel line. | One | Electrical harness plug G. |
| Speed of N_1 (LP) compressor, Smith pulse probe 2201/KGB/CP/l or /2 cable to control room. | One | |
| Speed of N ₂ (HP) compressor, Smith pulse probe 2101-/KGB/ CB/1 or /2 cable to control room. | One | |
| Low oil pressure warning switch, Smiths 2101/KPS/CP/1/20 attached at engine, electrical cable to control room. | One | Electrical harness plug H. |

Engine Test Instrumentation
Table 704 (Continued) (Sheet 3 - LH)

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| CONTROL ROOM | | | |
|---|----------------------|---------|--|
| INDICATOR TYPE RANGE AND METHOD | LOCATION | NO. OFF | |
| Temperature meter. Transitrol 1290 or 990. O to 300 deg C ± 5 deg C. | Temperature panel | One | |
| | Mamma ma kuwa | | |
| Temperature meter. Transitrol type 1290. O to 200 deg C + 5 deg C. | Temperature panel | One | |
| Temperature meter. Transitrol type 1290. O to 500 deg C ± 5 deg C. | Temperature panel | One | |
| Temperature meter. Sangamo Weston50 to +100 deg C + 1 per cent. | Fuel panel | One | |
| Percentage meter M.750/01/freq./ D.C. converter. Frequency read- out on Racal 9521. O to 120 per cent <u>+</u> 0.5 per cent. | Control panel | One | |
| Percentage meter M.750/01/freq./ D.C. converter. Frequency read- out on Racal 9521. O to 120 per cent + 0.5 per cent. | Control panel | One | |
| Warning lamp. | Control panel | One | |

Engine Test Instrumentation
Table 704 (Continued) (Sheet 3 - RH)

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| ENGINE TAPPING POINT PARAMETER TITLE - DESCRIPTION | NO. OFF | REMARKS |
|--|---------|----------------------------------|
| Reheat fuel rate of flow. Faure Herman. RA32CP volume flowmeter in reheat fuel line, electrical cable to control room. | One | Electrical harness plug F. |
| Oil tank contents. Smiths 920/ 1000/132 transmitter in oil tank, electrical cable to control room. | One | Electrical harness plug F. |
| Engine fuel rate of flow. Faure Herman. RA32CP volume flowmeter in engine fuel line, electrical cable to control room. | One | Electrical harness plug F. |
| HP fuel shut-off valve indication, engine mounted connections, electrical cable to control room. | One | Electrical harness plug G. |
| LP compressor front (No.1) bearing vertical vibration. Pick-up type CA900/4, Part No.144.902.000.04. (Circuit includes filter to record O-200 Hz only). Alternative, CA900/6(B), Part No.144.902.000.06. | | Electrical harness plug B. |
| Fuel filter differential pressure. Smith switch 1901/KPS/CP/1/7 tapping across filter 7 psi differential, electrical cable to control room. | One | Electrical harness plug C. |
| Oil tank overfull warning, micro- switch in oil tank electrical cable to control room. | One | Electrical harness plug F. |

Engine Test Instrumentation
Table 704 (Continued) (Sheet 4 - LH)

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| CONTROL RO INDICATOR TYPE RANGE AND METHOD | LOCATION | NO. OFF |
|---|------------------------|---------|
| Frequency counter Racal 9521. O to 600 gal/h <u>+</u> l gal/h. | Fuel panel | One |
| NOTE: Reading can be obtained by subtracting engine fuel rate of flow from total fuel flow. | • | · · |
| Contents gauge, Rolls-Royce Ltd. E.S.836 O to 100 per cent individual calibration. | Control panel | One |
| Frequency counter Racal 9521. 0 to 6000 gal/h + 1 gal/h. | Fuel panel | One |
| Lamp indicator, Rolls-Royce Ltd. In-out indication. | Warning light panel | One |
| Cirscale indicator, Record Ltd. 1 (MADC), 1 (K) 0 to 10 inch second ± 0.250 inch second. Charge amplifier. (Circuit includes filter to record 0-200 Hz only). | Control panel | One |
| Lamp indicator. 7 psi high differential pressure indication required. | Control panel | One |
| Lamp indicator, Rolls-Royce Ltd. On-off. NOTE: Light on for overfull. | Warning light panel | One |

Engine Test Instrumentation
Table 704 (Continued) (Sheet 4 - RH)



ENGINE TAPPING POINT

PARAMETER TITLE - DESCRIPTION

NO. OFF

REMARKS

Indication of reheat flame SNECMA ionisation probe protruding into jet stream, electrical cable to control room.

One

Electrical harness plug E.

Static pressure of HP compressor, delivery live line from HP compressor case to control room.

Installed when required for trouble-shooting only.

NOTE: When the engine has flight instrumentation attached, connect to dummy transducer block using adapters.

Fuel delivery pressure. A Fuel Pressure (Transducer) Adaptor Assembly (Tool 3170) must be fitted to the outboard main fuel delivery connection of the DDV (Distributor and Dump Valve) in place of blank ferrule (73-13-02, 2/160A).

One For use with

DEVS

equipment

Engine Test Instrumentation
Table 704 (Concluded) (Sheet 5 - LH)

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DEVS PC and software

CONTROL ROOM

| INDICATOR TYPE RANGE AND METHOD | LOCATION | NO. OFF |
|--|---|------------|
| Lamp indication. | Control panel | 0 n e |
| Standard test gauge, Budenberg. O to 250 psig <u>+</u> 0.25 per cent. | Control panel | One |
| DEVS signal conditioning equipment | Table mounted (Interim) Rack mounted (final version) | One One |

Engine Test Instrumentation
Table 704 (Concluded) (Sheet 5 - RH)

Table mounted

One



| TEST CELL PARAMETER TITLE - DESCRIPTION | NO. OFF | REMARKS |
|---|------------------|----------|
| Static pressure in test cell, live line from test cell to control room. | One | |
| Static pressure at venturi, live line from venturi to control room. | Four | (Ganged) |
| Static pressure of plant fuel, tapping into fuel supply line, live line to control room. | One | |
| Static pressure of starter air supply, live line to control room. | One | |
| Static thrust, Elliott load cell 'S' slaved to engine stand, cable to control room. | One | |
| Fuel flow to test plant, Avery Hardoll volume flowmeter B.H. 250 slave in test cell, electrical connection to control room. | One | |
| Position indicator of primary nozzle trim, CIC rotary pot. | One | |
| Temperature of bulk fuel, thermo- couple at engine fuel line electrical cable to control room. | One | |
| Ambient air temperature at the air intake30 to +50 deg C range. Electrical cable to control room. | One _. | |

Test Cell Instrumentation
Table 705 (Continued) (Sheet 1 - LH)

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| CONTROL ROOM | | | | |
|---|-----------------|---------|--|--|
| INDICATOR TYPE RANGE AND METHOD | LOCATION | NO. OFF | | |
| Manometer, Rolls-Royce Ltd. Perchloroethylene O to 60 in. Hg. + 0.05 in. Hg. | Manometer panel | One | | |
| Manometer, Rolls-Royce Ltd. Perchloroethylene O to 60 in. <u>+</u> 0.05 in. | Manometer panel | Four | | |
| Test gauge, Budenburg. 0 to 100 psig \pm 1 psig. | Pressure panel | One | | |
| Test gauge, Budenburg. O to 100 psig + 1 psig. | Pressure panel | One | | |
| Thrustmeter, Elliott 'S' O to 50000 lb + 50 lb. | Control panel | One | | |
| Frequency counter Racal 9521. O to 9000 gal/h + 1 gal/h. | Control panel | One | | |
| Cirscale indicator, Record Instruments Ltd., (mADC), 1 (K) O to 120 deg + 1 deg. | Control panel | One | | |
| Temperature meter, Transitrol 129020 to +30 deg C <u>+</u> 1 deg C. | Fuel panel | One | | |
| Temperature meter, -30 to +50 deg C range. | Control panel | One | | |

Test Cell Instrumentation
Table 705 (Continued) (Sheet 1 - RH)

| TEST CELL | - | · |
|---|---------|-------------|
| PARAMETER TITLE - DESCRIPTION | NO. OFF | REMARKS |
| Specific gravity of fuel, sample tapping at fuel cabinet. | One | · · · · · · |
| Temperature of control room clinical thermometer. | One | |

Test Cell Instrumentation
Table 705 (Concluded) (Sheet 2 - LH)

TN37



| CONTROL ROOM | | | | |
|----------------|--------------------------|--|--|--|
| LOCATION | NO. OFF | | | |
| Test equipment | One | | | |
| Test equipment | One | | | |
| | LOCATION Test equipment | | | |

Test Cell Instrumentation
Table 705 (Concluded) (Sheet 2 - RH)



2. Receipt of Engine for Installation in the Test Cell

A. General.

- (1) Ensure that all the appropriate documentation has accompanied the engine, and that the log books, log cards, rig test tallies, electrical test sheets, concession notes, and modification statements are correctly signed, permitting the testing of the engine. Any concessions and/or modifications affecting the test running must be noted, and the test schedule for the appropriate standard used. If required raise a proforma check list to cover all documentation and loose items.
- (2) Examine the engine for damage and general condition. Ensure that all openings are correctly blanked and that quick attach/detach clamps secure blanks on the main and standby hydraulic pump and IDG mounting faces.

3. <u>Installation of Slave Accessories on the Engine</u>

A. Air Starter.

(1) General.

The air starter is secured to the right-hand accessory gearbox by a quick attach/detach clamp ring. The following procedure details the installation of the air starter without the air starter shut-off valve.

- (2) Prepare to Install Air Starter (Ref.Fig.701).
 - (a) Remove the blank from the accessory gearbox, starter and shut-off valve aperture if installed.
 - (b) Ensure that all joint faces, the locking and thread segments, the clamping bolt and spherical washer, and the starter splines are clean and free from damage and corrosion.
 - (c) Lightly apply lubricant 'A' to the clamping bolt, spherical washer and the coupling ring thread segments.
 - (d) Lubricate the mating surfaces of the starter and the accessory gearbox with anti-seize compound 'B'.



- (e) Smear the faces of the shut-off valve V-flanged mounting joints with anti-seize compound A.
- (3) Install Air Starter.
 - (a) Position a new seal (80-11-11/3-220) in its seating on the joint face of the starter.
 - (b) Engage the starter drive with the accessory gearbox drive shaft, and the locating dowels with their mating holes.
 - (c) Press the starter into position until its joint face abuts that of the gearbox.
 - (d) With the starter pressed squarely into its installed position, ensure that the coupling ring thread segments are engaged with the slots, then turn the coupling ring counter-clockwise, to bring the brackets together, and engage the threaded portion of the ring with the flange as far as possible, by hand.

CAUTION: ENSURE THAT THE LOCKING THREADS
HAVE ENGAGED FREELY BEFORE APPLYING
TIGHTENING FORCE TO THE COUPLING
RING.

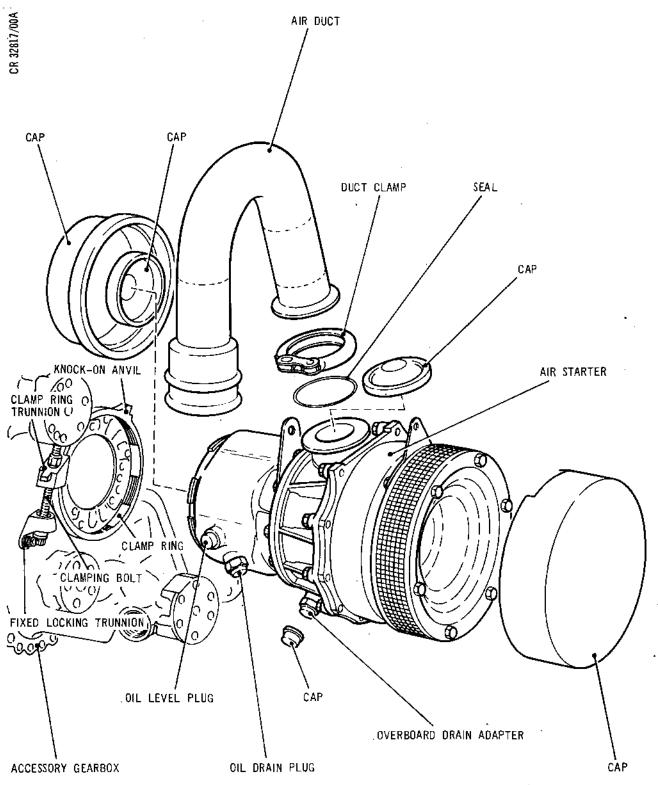
- (e) With the spherical washer (72-63-01/3-20) positioned on the clamping bolt (72-63-01/3-10), insert the bolt through the fixed mounting bracket (72-63-01/3-120), and screw it into the spherical nut (72-63-01/3-100) of the clamp ring coupling.
- (f) Measure the run-down torque of the locking bolt by screwing in the bolt until the bolthead and spherical washer are not quite in contact and noting the torque required to turn the bolt.

 The run-down torque must be between 6.5 and 60 lbf in. (0.7 and 6.8 N.m).
- (g) Screw in and hand-tighten the locking bolt with spanner (Tool 2511), using one hand only.

NOTE: This operation provides a positive full run-down of the locking bolt near to the final tightening position without exceeding the torque loading limit.

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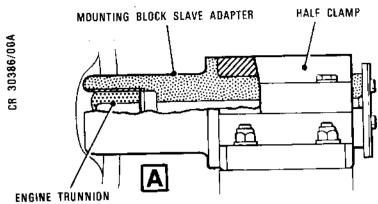
Air Starter Installation Figure 701

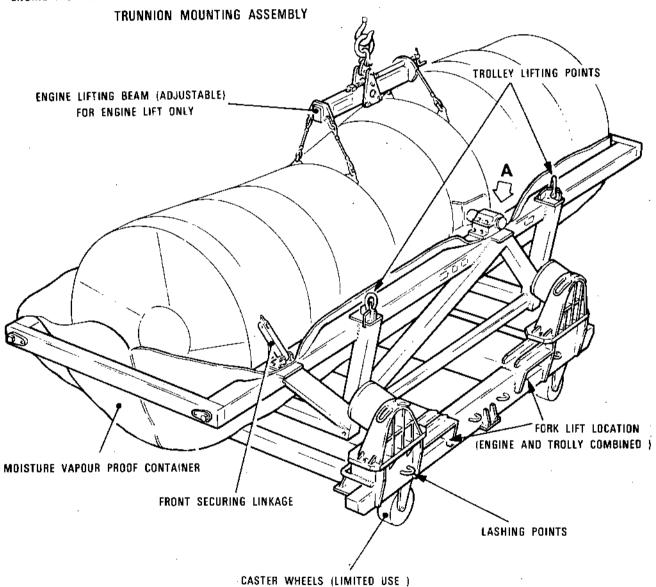
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- (h) Torque-tighten the locking bolt to between 170 and 190 lbf in. (19,2 and 21,5 N.m).
- (j) Tap radially around the periphery of the coupling ring, where accessible, using a hide face hammer or a 8 oz (0.266 kg) hammer and aluminium drift, to ensure even disposition of the ring.
- (k) Measure the torque loading remaining on the locking bolt.
- (1) Repeat the torque-tightening and tapping until the two following conditions are met. There is less than 18 lbf in. (2,0 N.m) between the specified torque load and the torque load remaining after tapping and also the bolt is torque-tightened to between 170 and 190 lbf in. (19,2 and 21,5 N.m).
- (m) Remove blank from union and install drain tube.
- (n) Torque-tighten the drain pipe union nut to between 40 and 65 lbf in. (4,5 and 7,3 N.m) and wire-lock.
- (p) Place container (700 cc capacity) under starter drain plug, remove drain plug and level plug, allow oil to drain.
- (q) Install the drain plug with a new sealing washer and torque-tighten the drain plug to between 255 and 260 lbf in. (28,8 and 29,4 N.m).
- (r) Place container under level plug. Inject 550 cc clean engine oil as being used in the engine under test through level plug hole with syringe until oil flows from level plug hole. Allow oil to drain until flow ceases, install level plug with new sealing washer.
- (s) Torque-tighten the level plug to between 255 and 260 lbf in. (28,8 and 29,4 N.m).
- (t) Secure the flange of the test cell air duct to the air shut-off valve mounting orifice using a Q.A.D. clamp with the faces smeared with anti-seize compound A. Torque-tighten the securing nut to between 45 and 50 lbf in. (5,1 and 5,6 N.m).







Removal of Engine from Transport Stand Figure 702

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- B. IDG Slave Pressure Blank.
 - (1) Remove the transportation blank from the IDG mounting face on the right-hand gearbox.
 - (2) Install one of the alternative blanks (72-63-00, Tool 740 or 72-00-25, Tool 3070) as detailed in para.(a) or (b).
 - (a) Install the pressure test blank (72-63-00, Tool 740).
 - (i) Assemble the Corruplus seal (72-63-01/8-30) into the plain flange at the IDG mounting location.
 - (ii) Position the test blank on the gearbox.

 Locate the dowel in the blank with the hole in the plain flange and the interrupted threads on the blank in the coupling ring, then rotate the coupling ring to lock.
 - (iii) Ensure that the coupling ring bolt has a locking (run-down) torque between 6 and 20 lbf in. (0,68 and 2,26 N.m), then torque-tighten between 170 and 190 lbf in. (19,2 and 21,5 N.m), (Ref. 72-09-00, Assembly) with lubricant 'A' applied.
 - (b) Install the pressure blank cover (Tool 3070).
 - (i) Remove the bolt and retainer sleeve which secure the splined shaft in the IDG spur gear drive, then withdraw the splined shaft.
 - (ii) Screw the bolt and retainer sleeve into the spur gear drive and torque-tighten between 67 and 73 lbf in. (7,6 and 8,2 N.m).

NOTE: Installation of the bolt and retainer sleeve prevents excessive oil flow through the drive during test running.



- (iii) Assemble the Corruplus seal (72-63-01/8-30) into the plain flange at the IDG mounting location.
- (iv) Assemble the blank cover to the gearbox. Align the dowel in the cover with the hole in the plain flange and locate the interrupted threads in the coupling ring. Rotate the coupling ring to lock.
- (v) Ensure that the coupling ring bolt has a locking (run-down) torque between 6 and 20 lbf in. (0,68 and 2,26 N.m), then torque-tighten between 170 and 190 lbf in. (19,2 and 21,5 N.m), (Ref. 72-09-00, Assembly) with lubricant 'A' applied.

4. Installation of Engine in the Test Cell

A. General.

The engine may be mounted in the test cell using a pedestal mounting or an overhead rail mounting, the two methods of installation are detailed.

- B. Prepare the Test Cell to Receive the Engine.
 - (1) Ensure that the test cell is clean and all tubes, electrical cables and ducts are correctly positioned to prevent damage during engine installation.
 - (2) Ensure the detuner unit, jet pipe, and air intake assembly are positioned to permit location of the engine into its mounting blocks secured to pedestals on each side of the test bed.
 - (3) Position instrumentation and electrical harness looms to enable easy connection to the power plant after its installation.
 - (4) Check for security of attachment and cleanliness of the mounting block assemblies. Insert the half rings in the grooves provided in the mounting blocks.



- (5) Ensure that the vapour extraction ducts are correctly positioned to align with the No.2, 3, 4, 5 and 12 labyrinth outlet pipes protruding beneath the engine.
- C. Prepare Engine for Removal from the Transport Stand (Ref.Fig. 702).
 - (1) If installed, open the Moisture Vapour Proof bag (M.V.P.). Pull the bag to the sides of the transport stand and expose the top half of the engine.

NOTE: The M.V.P. bag is attached to the transport stand beneath the mounting block and remains attached to the stand whilst the engine is being removed.

- D. Remove Engine from Transport Stand (Ref.Fig.702).
 - (1) Secure hoist (five ton minimum load 5,080 Kg) to lifting beam (Tool 2501).
 - (2) Position lifting beam over engine and secure straps to engine with pins.
 - (3) Adjust lifting beam in the horizontal plane using positioning handle as required within the limits of the calibrated scale.
 - (4) Take weight of engine on hoist and remove the slave bolts from the two front struts at their attachment to the air inlet case.
 - (5) Pull the struts clear of the air inlet case, releasing the front of the engine from the stand. Stow the slave bolts in the stand.
 - (6) Remove the four bolts securing half caps to the mounting blocks. Remove the half caps.
 - (7) Carefully raise the engine approximately 12 in. (305 mm) and withdraw the slave trunnion carriers from the engine trunnions.
 - (8) Hoist the engine clear of the transport stand.



- (9) Stow removed hardware on stand for future use.
- (10) Proceed with next operation, do not leave engine suspended from hoist.
- E. Prepare Test Bed (Ref.Fig.703).
 - Inspect the engine for general condition, damage, blanking and security of attachment of all engine accessories.
 - (2) Assemble the bearing carriers to the engine trunnions.
 - (a) Inspect the trunnions (71-20-00/1-60), spherical bearings (E511385100), bearing carriers, capnuts, circlips and half rings for general condition and apply lubricant A.
 - (b) Slide the bearing carrier retaining capnuts onto the trunnions with the threads facing outward, then slide the sperical bearings onto the trunnions and secure with the circlips.
 - (c) Slide the bearing carriers over the spherical bearings and screw into the capnuts. Align the locking grooves and torque-tighten the capnuts onto the bearing carriers.
 - (d) Insert the locking pieces in the grooves and secure in position by screwing the locking screws into the threaded holes in the carriers.

NOTE: The spherical bearings are retained by the circlips on the trunnions and housed between the bearings carriers and their retaining caps. Lateral expansion of the engine is facilitated by movement of the trunnions within the spherical balls.



- (e) Position the attachment sleeve of the 2, 3, 4, 5 and 12 hot and cold vents over the engine outlet pipes, the sleeves are held in position by the tension of the piston rings located in grooves in the engine outlet pipes, push the sleeves to the uppermost position, ensure alignment of the sleeves with the extraction pipes during the installation of the engine.
- F. Install Engine Using Pedestal Type Mounting (Ref.Fig.703, 704 and 705).
 - (1) Check that the mounting blocks are securely bolted to the pedestals, then place the half rings in the grooves provided.
 - (2) Position engine over the test bed, aligning the engine bearing carriers with the test bed mounting blocks.
 - (3) Carefully lower the engine into the test bed and guide the trunnion carriers into the mounting blocks. Insert the half rings into the grooves of the bearing carriers, then place the half caps over the half rings and bearing caps, and loosely attach the securing bolts.

NOTE: The bolts are torque-tightened after attachment of the front scissor structure plate to its support beam, and when the engine centralisation has been satisfied.

- (4) Secure each double and single fork link to the four engine front support points with four bolts, washers and self-locking nuts. Torque-tighten nuts to between 80 and 85 lbf in. (9,0 and 9,6 N.m).
- (5) Release cross beam clamping bolts and move cross beam to align yoke with previously installed double ended links. Secure links to yoke with two pins. Secure pins with safety pins.



- (6) Disconnect the four lifting straps from the engine attachment points and hoist beam clear of the engine. Store beam for future use.
- (7) Secure the centralizing pin housing and linkage to engine rear support points with two bolts, washers and self-locking nuts. Torque-tighten nuts to between 85 and 90 lbf in. (9,6 and 10,7 N.m).
- (8) Align centralising setting bar with centralising pin housing and insert pin. Secure pin with safety pin.
- (9) Swing the arm attached to the top of the pedestal from its parked position parallel to the engine, to the lateral position across the engine against the stop built into the pedestal cap. Lift the centralising pin against its spring and avoid fouling the side of the centralising pin housing.
- (10) With the beam correctly positioned, lower the pin into the housing and tighten the capstan bolt securing the beam to the pedestal by hand. Remove centralising setting bar from the centralising housing and pedestal.
- (11) Tighten the two capstan bolts securing the front cross beam by hand.
- (12) Torque-tighten the bolts securing the half caps to the mounting blocks to between 120 and 130 lbf in. (13,6 and 14,7 N.m) and wire-lock the bolts to each other in pairs.
- (13) Remove the air intake cover from the engine (Ref. Fig. 712).
 - (a) Unscrew the wingnuts of the air intake blanking cover brackets.
 - (b) Remove the blanking cover using handles provided.

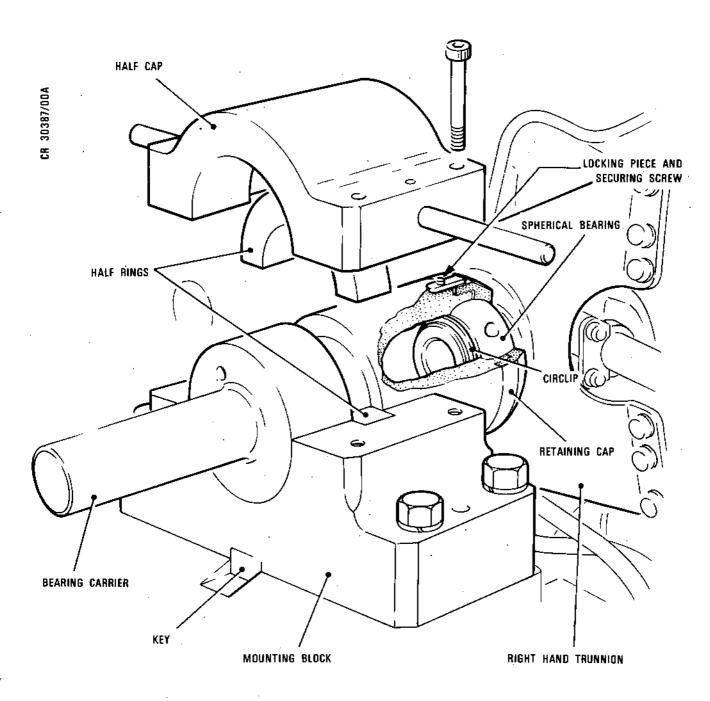


- (14) Check that engine is square with test stand by using a spirit level on the front face of engine air intake.
- (15) Inspect the air intake area for general condition, cleanliness, damage and freedom from foreign objects.
- (16) Secure air intake assembly (item 2, Table 702) to the engine (Ref.Fig.706).
 - (a) Ensure clamp is clean and dry and install on the flanges of the engine and the air intake.
 - (b) Position air intake and clamp. Evenly torquetighten the nuts to between 25 and 30 lbf in. (2,8 and 3,4 N.m).
 - (c) Lightly tap the clamp around the periphery using a soft faced hammer to ensure a good seating of the clamp onto the flanges and re-torque-tighten the securing nuts if required.

NOTE: After first engine run, re-torque-tighten the securing nuts.

- (17) Remove the exhaust duct cover from the engine (Ref.Fig.712).
 - (a) Unscrew the wingnuts of the exhaust duct cover brackets.
 - (b) Remove the blanking cover using handles provided.
- (18) Attach hoist (minimum five ton load) to the lifting eye of dynamometer.
- (19) Attach the lifting link of the dynamometer to the lifting eye of the primary nozzle lifting beam.
- (20) Attach the lifting beam to the primary nozzle and jet pipe assembly.
- (21) Position the lifting beam over the jet pipe and primary nozzle.
- (22) With the dynamometer hook located in the rear eye of the lifting beam, insert the quick-release pins to secure the lifting beam to the primary nozzle support ring attachment point.

TESTING

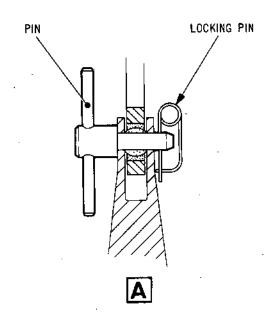


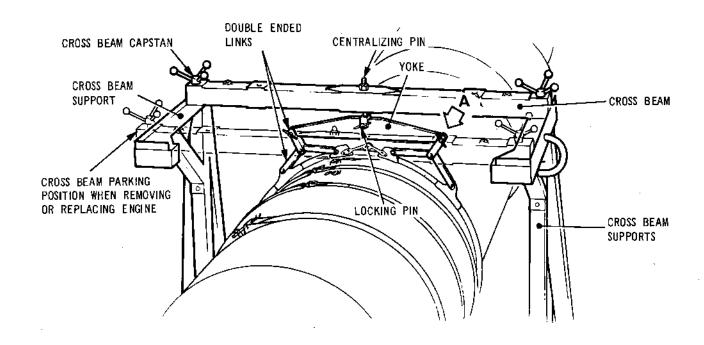
Installation of Bearing Carriers to Engine Trunnions Figure 703

TESTING

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Engine Front Support Installation on Test Bed Figure 704

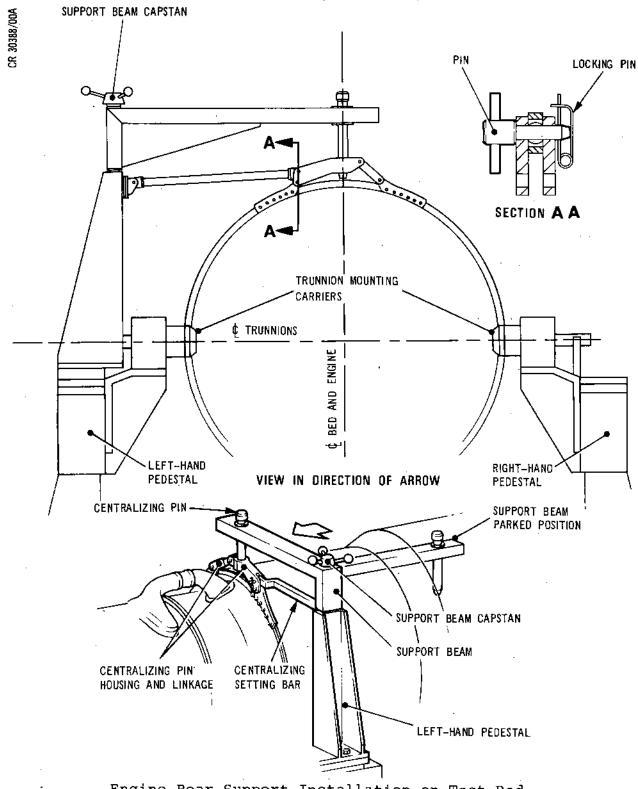
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- (23) Carefully raise the hoist until the weight of the unit is supported by the lifting beam.
 - NOTE: The reading on the torque dynamometer must not exceed 1500 lb (681 Kg) which is the approximate weight of the primary nozzle and jet pipe assembly.
- (24) Release the two bolts which secures the primary nozzle support ring to the trolley support feet on each side of the transport trolley.
- (25) Release the outer support ring from the open end of the jet pipe and remove the location pads from around the jet pipe periphery.
- (26) Remove the two location bolts from the support ring brackets at their attachment to the trolley frame.
- (27) To prevent distortion to the jet pipe, ensure that resizing tool (Tool 2502) is installed in the orifice. Refer to 78-11-01 Reheat Jet Pipe for installation of resizing tool.
 - CAUTION: DO NOT LEAVE UNIT SUSPENDED FROM SLING AS DAMAGE MAY RESULT. PROCEED WITH NEXT OPERATION.
- (28) Secure the primary nozzle and jet pipe to the test bed and engine.
 - NOTE: Before proceeding with the installation of the jet pipe, ensure that dimensions required for checks are carried out, (Ref.para.5.A.(4)), if required.
 - (a) Ensure that the exhaust detuner assembly is positioned clear of the primary nozzle area, and that a suitable walkway is positioned to link up with the right and left-hand walkways each side of the engine.
 - (b) With the primary nozzle and jet pipe assembly suspended from the hoist, position the primary nozzle assembly over the test bed at the rear of the engine.

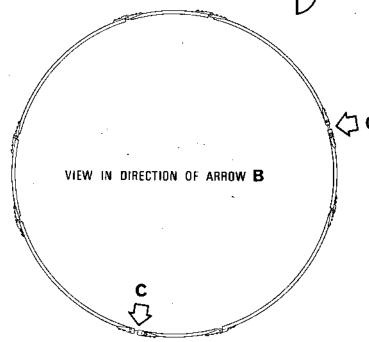
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Engine Rear Support Installation on Test Bed Figure 705

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Installation of Slave Air Inlet Assembly Figure 706

SPHERICAL BUSH ----

WASHER

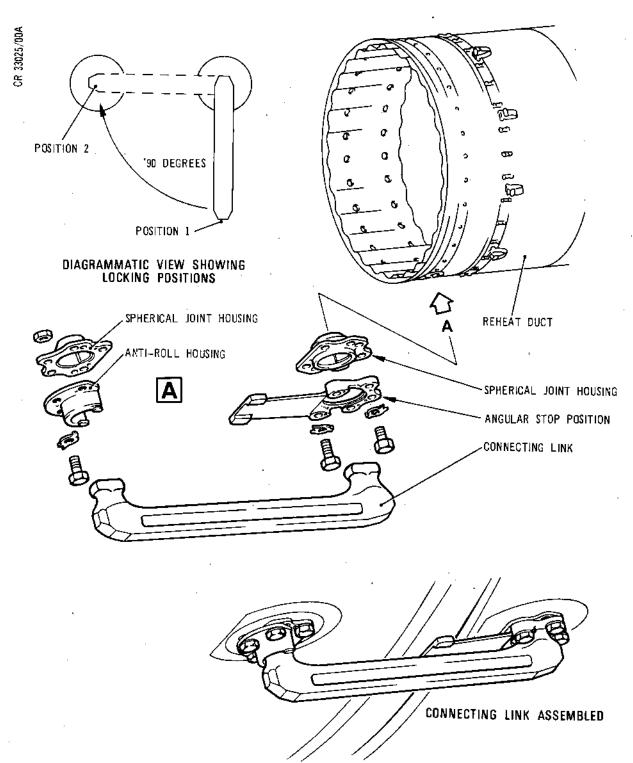
NUT

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- (c) Ensure that the location bars in the nozzle support frames located each side of the test bed are in the disengaged position.
- (d) Position the torque tie tubes to align with the nozzle support location ring.
- (e) Carefully lower the primary nozzle and jet pipe into position at the rear of the engine and align the forward orifice of the jet pipe with the engine turbine exhaust diffuser.
- (f) Steadily move the jet pipe and nozzle forward towards the engine and engage the mouth of the jet pipe into the engine jet pipe adapter.
- (g) Insert the location bars in the support frames at the right and left-hand side of the engine into the mating holes at the right and left-hand side of the primary nozzle support ring.
- (h) Secure the location bars in position by inserting the locking pins into the primary nozzle support frames.
- (j) Attach the torque tubes to the right and lefthand side of the nozzle support frame and secure in position.
- (29) Remove resizing tool (Tool 2502) from the jet pipe orifice (Ref. 78-11-01).
- (30) Install the connecting link (78-11-01/4-120) between the reheat jet pipe and engine (Ref. Fig. 707).
 - (a) Install the spherical bearing housing (78-11-01/4-50) on the reheat duct.
 - (b) Position the angular position stop (78-11-01/4-60) on the spherical bearing housing and secure both items to the reheat jet pipe with three bolts (78-11-01/4-10) and two bolts (78-11-01/4-30) complete with three tabwashers (78-11-01/4-20) and two tabwashers (78-11-01/4-40). Smear threads of bolts with lubricant'B' and torque-tighten to between 88 and 97 lbf in. (10 and 11 N.m) and lock tabwashers.

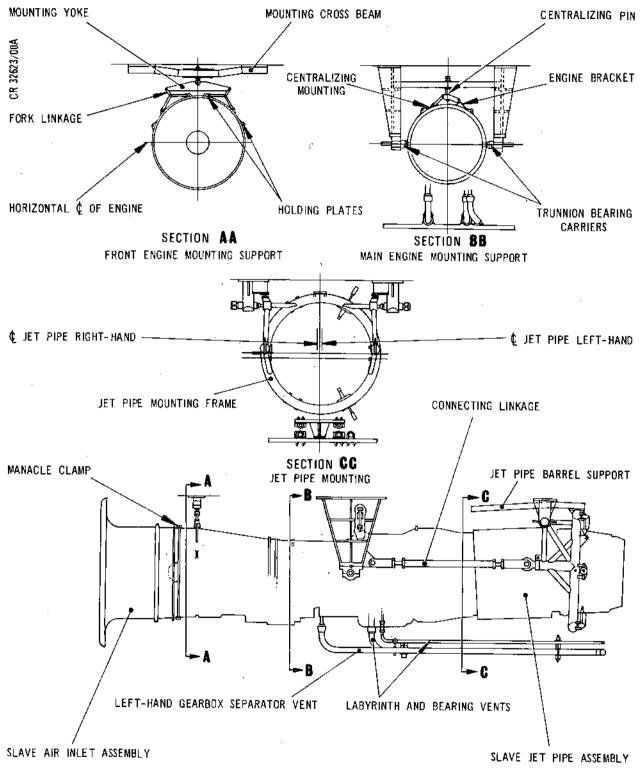
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Installation of Connecting Link Figure 707

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Engine Overhead Support Installation Figure 708

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- (c) Position on one end of the connecting link the anti-roll housing (78-11-01/4-110), spherical bearing housing (78-11-01/4-100), five bolts (78-11-01/4-80) and tabwashers (78-11-01/4-90). Secure to connecting link with slave nuts (78-11-01/4-70). Smear threads of bolts with lubricant 'B!
- (d) Insert the other end of the connecting link into the previously installed spherical bearing housing and rotate 90 deg to align connecting link.
- (e) Remove slave nuts previously installed and secure the anti-roll housing together with the spherical bearing housing installed on the connecting link to the engine. Torque-tighten bolts to between 88 and 97 lbf in. (10 and 11 N.m).
- (f) Install protector (Tool 2503).
- (31) Remove the hoist, torque dynamometer and the primary nozzle lifting beam from the primary nozzle assembly, by releasing the quick release pin on the lifting beam from the primary nozzle.
- (32) Hoist the lifting beam torque dynamometer clear of the primary nozzle and lower to the ground, store the lifting beam and torque dynamometers for future use.
- G. Install Engine Using Overhead Type Mounting (Ref. Fig. 708).
 - (1) With engine removed from transport stand, ensure slave bearing carriers are removed and install correct bearing carriers to suit overhead supported test cell configuration.
 - (2) Secure centralising mounting to engine brackets on gas generator case.
 - (3) Position engine using centralising pin on main engine mounting support centralising bracket previously installed on engine.



- (4) Secure engine bearing carriers to main engine mounting support using two trunnions.
- (5) Secure front of engine to overhead mounting support by attaching holding plates secured to low pressure case of engine to the fork linkage which is in turn secured to the mounting yoke and cross-beam (Ref. Fig. 708).
- (6) Position and secure slave jet pipe and primary nozzle to engine and adjust as necessary using connecting linkage (Ref.para.4.F.(28)).
- (7) Install air intake assembly on engine with static tappings in correct position and secure with a manacle clamp (Ref.para.4.F.(16)).

5. Engine Test Components Measurement Checks

- A. Carry Out Dimensional Check Between the Engine and the Jet Pipe.
 - (1) Check the alignment of jet pipe to engine. The nozzle dimensions are taken at four positions 3, 6, 9 and 12 O'clock between the jet pipe entry into turbine casing outlet lip and the recessed line on the jet pipe (just forward of the screech lining) and further readings at the jet pipe to primary nozzle connections.
 - (2) The settings must be aligned by using the four adjusters two vertical and two lateral on the primary nozzle support ring pedestal, (and if necessary the tie rods between primary nozzle support ring pedestal and main engine mounting.
 - (3) Measure the dimensions 'A' and 'B' (Ref.Fig.709) and Table 706.
 - NOTE: Table 706 gives the dimensions 'A' and 'B' with any type of jet pipe used with a 'K' mounted engine.
 - (4) In some instances the spherical flange adapter has a sealing strip which makes it impossible to measure dimension 'A' directly, proceed as follows:

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(a) Measure the distance between the upstream edge of the jet pipe and the upstream edge of the anti-screech liner before the jet pipe is installed. Record measurement as dimension 'D'.

NOTE: Dimension 'D' measurement is approximately 0.197 inch (5 mm).

- (b) After installation of the jet pipe, measure the distance from the edge of the anti-screech liner to the sealing strip flange. Record measurement as dimension 'C'.
- (c) Subtract dimension 'D' from dimension 'C' to find the required dimension 'A'.
- (5) If the dimensions 'A' and 'B' are outside the values of Table 706 and a simple adjustment does not effect a curve then an increase of the tolerances is allowed, as follows:
 - (a) Type 10 Pipe

Dimension 'A' increased tolerance of + 5 mm.

Dimension 'B' increased to 97 mm or decreased to 75 mm but with a maximum out of parallel of 10 mm.

(b) Production Type 14 Pipe

No increase in tolerances allowed.

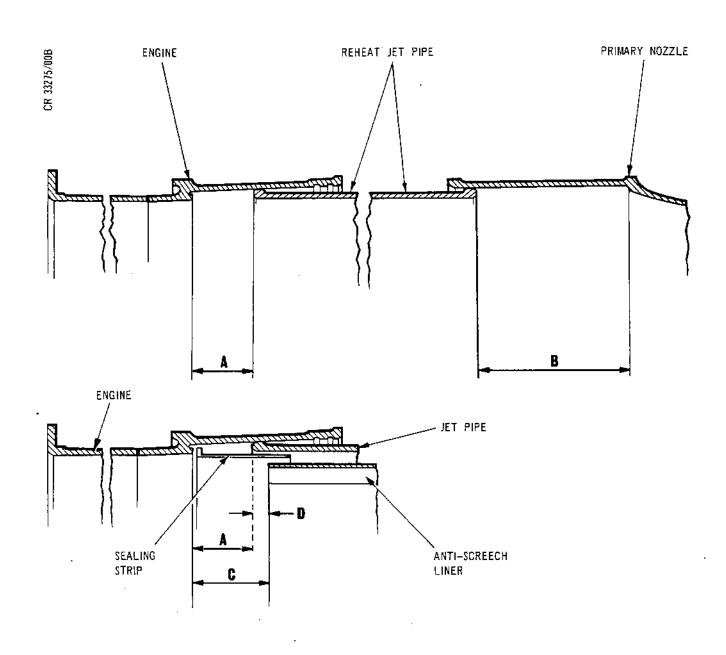
NOTE: Primary jet pipes are normally right hand installations.

Connect Engine Test Services

A. General.

Connect the engine test services to the engine as detailed in paragraph B, following. The length of cables and live lines being dependent on the design of the test cell. Remove blanks (as applicable) as each connection is made.





Jet Pipe and Engine Dimensional Check Figure 709

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- B. Test Service Connections.
 - (1) Air supply to starter (Ref.Fig.701).
 - (a) Install adapter (Ref. Table 703, item 10) to air starter connection and secure with manacle clamp.
 - (b) Connect air supply hose to adapter.
 - (2) Main fuel supply connection.
 - (a) Install adapter (Ref.Table 703, item 9) to main fuel inlet and secure with manacle clamp.
 - (b) Connect fuel supply hose to adapter.
 - (3) Fuel recirculating connector.
 - (a) Connect recirculating connector (Ref.Table 703, item 11) to main fuel inlet adapter.
 - (b) Install recirculating hose return to connector and secure with manacle clamp.
 - (4) Venturi static pressure (Ref.Fig.706).

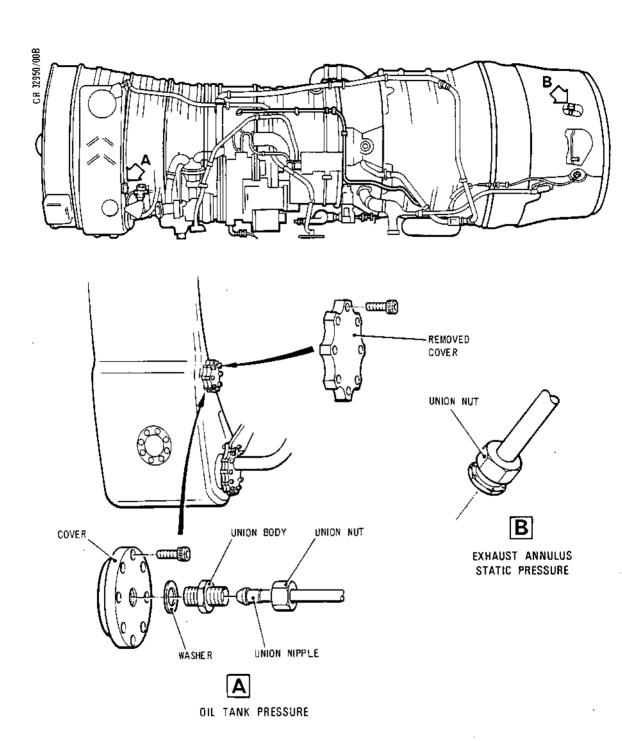
Connect live lines to venturi static pressure connections.

(5) Anti-icing static pressure (Ref.Fig.710).

Connect live line to anti-icing connection with nut, 0.4375 -20 UNJF-3B.

- (6) Exhaust annulus total exit pressure (Ref.Fig.710).
 - (a) Install adapter (Ref.Table 703, item 8) to LP pressure take-off point.
 - . (b) Connect live line to adapter connection.
- (7) Engine oil pressure.
 - (a) Engine oil pressure is measured by one of the following methods:
 - (i) By means of a calibrated oil pressure transmitter mounted at the engine oil pressure transmitter position.

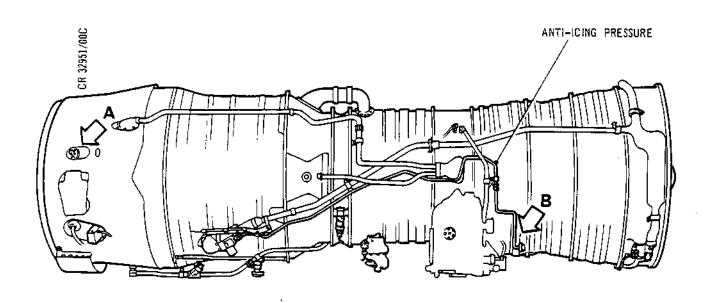


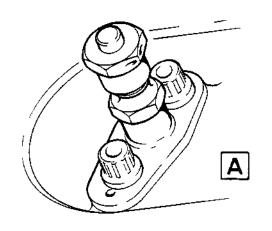


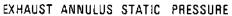
Engine/Test Cell Connections
 Figure 710 (Sheet 1 of 3)

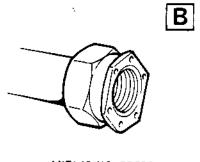
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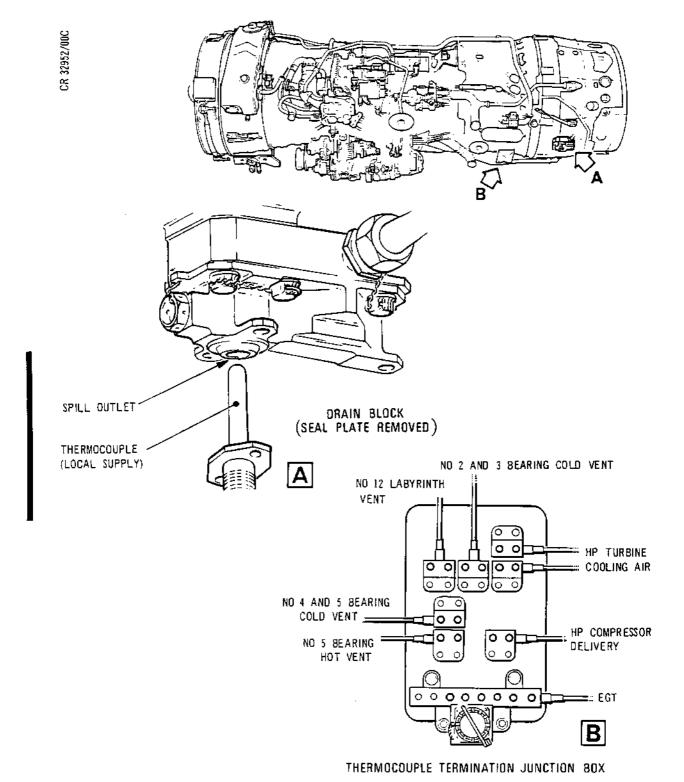




ANTI-ICING PRESSURE

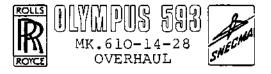
Engine/Test Cell Connections Figure 710 (Sheet 2 of 3)

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Engine/Test Cell Connections Figure 710 (Sheet 3 of 3)

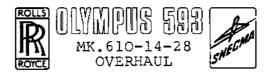
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| Jet Pipe | | Dimension "B" (mm) | | | |
|-------------------|-------------------|--|---|--|--|
| Link Length mm | Installation | 12 | Clock po | sition 6 | 9 |
| | R.H. | | | | |
| 269 | or | | | | |
| | L.H. | 15 mm. | | |) E |
| 207 | R.H. | 59 | 59 | 59 | 59 |
| 14 296 PS 6000 | L.H. | 59 | 59 | 59 | 59 |
| • | Link Length mm | Link Installation Length mm R.H. 269 or L.H. R.H. | Jet Pipe Link Installation Length mm R.H. 269 or 65 - fals L.H. 15 m R.H. 59 | Jet Pipe Link Installation Length mm Clock po 12 3 R.H. 269 or 65 - 95 mm w false parall L.H. 15 mm. R.H. 59 59 | Jet Pipe Link Installation Length mm Clock position 12 3 6 R.H. 269 or 65 - 95 mm with a m false parallelism of L.H. 15 mm. R.H. 59 59 59 |

Jet Pipe and Engine Dimensional Check Table 706 (LH)

Ð



| | Jet Pipe | Installation | Dimension "A" (mm) |
|------------------|-------------------|--------------|---|
| Jet Pipe Type | Link Length mm | | Clock position 12 3 6 9 |
| 10 | 269 | R.H. | Minimum 20 mm (on jet pipe link side) |
| 10 | 203 | L.H. | Maximum 50 mm (anywhere on circumference) |
| Production | 20.6 | R.H. | 52 41.5 52 62.5 |
| 14 PS 6000 | 296 | L.H. | 52 62.5 52 41.5 |
| | • | | |

Jet Pipe and Engine Dimensional Check Table 706 (RH)

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- (ii) By means of a pressure test assembly, comprising a test block and slave gauge, mounted at the oil pressure switch position.
- (b) Refer to Table 703 item 6 for details of pressure test equipment.
- (8) Paragraph deleted.
- (9) Oil tank pressure (Ref.Fig.710).
 - (a) Remove cover plate, (79-11-01/1-300).
 - (b) Secure adapter set (Ref.Table 703, item 5) to oil tank.
 - (c) Connect live line to adapter set.
- (10) Electrical harness (Ref.Fig.711).
 - (a) Disconnect the seven plugs from their mating dummy receptacles.
 - (b) (Mod.OL.8180 incorporated). Remove nut, washer and bolt securing spring clip to bracket. Remove the clip from the tube and retain for transportation purposes.
 - (c) Remove two wingscrews securing the mounting plate to brackets. Remove the mounting plate from the engine and retain for transportation purposes.
 - (d) Support A. Remove the wingscrew securing the clamp to the bracket.
 - (e) Support B. Unstrap the support from the tube.
 - (f) Support C. Unclip the support from the tube.
 - (g) Support D. Unclip the support from the tube.
 - (h) Support E. Remove the wingscrew securing the support to the clip.
 - (j) Connect the Cannon plugs to the control room connections.

ATP TEMPORARY REVISION

British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

This Temporary Revision complies with BCAR's Chapter A6-2 and TSS No.0-2

Denin horadall

For Chief Technical and Industrial Services Engineer CAA Design Approval No.DAI/8566/78

TEMPORARY REVISION NO.72-574

Insert in 72-00-25 after page 750.

REASON FOR ISSUE

BEOL NOTE added

ACTION

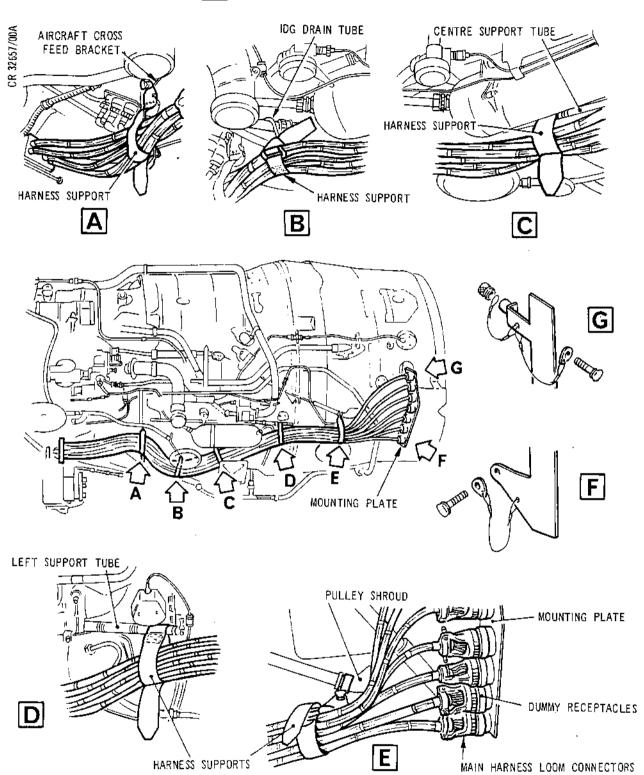
Read the following NOTE after the heading for paragraph (10):-

BEOL NOTE:

Having obtained the electrical harness in the configuration required for Engine Test, it is adviseable to carry out those checks currently specified in Chapter 71-00-03 Engine Dispatch Page 551 Para 6 - Rig Test and Final Installation

Check of Main Electrical Harness.

X6033



Electrical Harness Stowage Figure 711

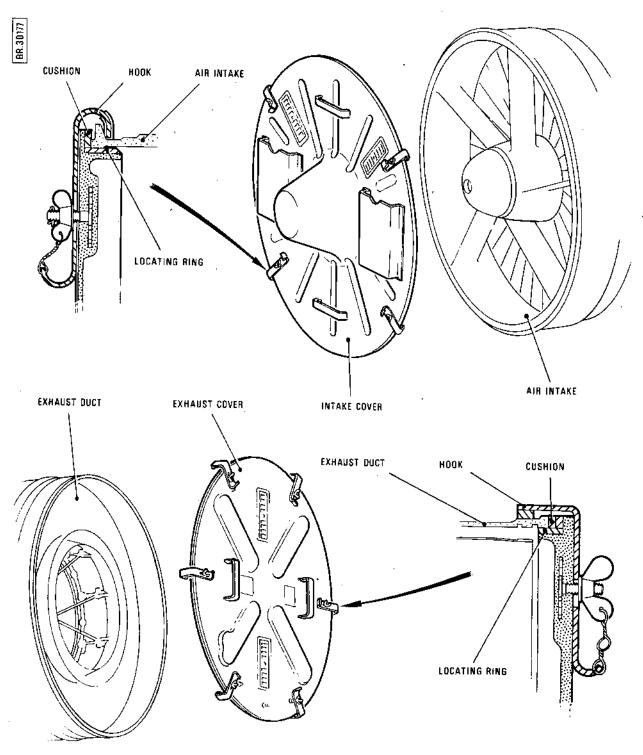
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- (11) Paragraph deleted.
- (12) LP turbine static pressure.
 - <u>NOTE:</u> Not normally installed except when trouble shooting.
 - (a) Remove part (SNECMA 525.293.138.0).
 - (b) Install adapter B.451842 and union body B.376203.
- (13) Turbine drain valve indicator.
 - (a) Place indicator in a position such that it can record a temperature change when the drain valve opens.
- (14) Jet pipe flexible drain hose.
 - (a) Connect the flexible drain hose to the jet pipe connection if it has been removed. Torque-tighten the connection to between 160 and 180 lbf in. (18,1 and 20,3 N.m) and wire-lock.
- (15) Primary nozzle air supply.
 - (a) Remove the ten bolts, cupwashers and the air duct vane cover from vane No.2 or 8, as required, on the HP compressor diffuser case.
- (16) A slave blank union and transducer (Ref. Table 704) should be installed to the outboard fuel delivery connection DDV in place of blank ferrule (73-13-02, 2/160A).





Air Intake and Exhaust Duct Covers Figure 712

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- (b) Apply lubricant 'B' to the ten bolts, then assemble the slave TRA elbow (Ref. Table 703 Item 15) to the vane at No.2 or 8 position and secure with the bolts and cupwashers.
- (c) Torque-tighten the ten bolts between 70 and 80 lbf in. (7,9 and 9,0 N.m).
- (d) Inspect the air supply tube ends and connection points for cleanliness and damage prior to attachment.
- (e) Connect the air supply tubes between the slave TRA elbow and the primary nozzle control (PNC) and between the PNC and the primary nozzle actuator air jack supply manifolds.

NOTE: Type 14 jet pipe has only one P₃ air tube connected to the 'closing' position of the air jack supply ring. Ensure the 'opening' position of the air jack supply ring is vented to atmosphere.

- (16) Thermocouple termination junction box electrical connections (Fig. 710).
 - (a) Connect the electrical terminals at the junction box located beneath the engine attached to a bracket and mounting studs on the combustion chamber outer case at the six o'clock position.
- (17) Engine vents.
 - (a) Connect the sleeves attached to the engine hot and cold vents to the test cell extraction vents.

NOTE: Refer to paragraph 12 for electrical test cell and hook-up requirements for testing on engine.

7. Disconnect Engine Test Services

- A. General.
 - (1) Establish that all running and inspection requirements have been satisfied.

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(2) As each tube is disconnected, install blanks on the engine and test facility connections. Protect all disconnected electrical cable connections from oil, fuel and damage to pins.

<u>CAUTION</u>: ENSURE THAT ALL ELECTRICAL AND FUEL SERVICES ARE OFF.

- B. Disconnect Test Services.
 - (1) Air supply to starter (Fig. 701).
 - (a) Disconnect air supply hose from adapter.
 - (b) Release manacle clamp and remove adapter.
 - (2) Fuel recirculating connector.
 - (a) Release manacle clamp and remove recirculating hose return from connector.
 - (b) Remove connector from main fuel inlet adapter.
 - (3) Main fuel supply connection.
 - (a) Disconnect fuel supply hose from adapter.
 - (b) Release manacle clamps and remove adapter from main fuel inlet.
 - (4) Venturi static pressure (Ref.Fig.706).

Disconnect live lines from venturi pressure connections.

- (5) Anti-icing static pressure (Ref.Fig.710).
 - Disconnect live line from anti-icing connection.
- (6) Exhaust annulus total exit pressure (Ref.Fig.710).
 - (a) Disconnect live line from adapter connection.
 - (b) Remove adapter set from LP pressure take-off point.



- (7) Engine oil pressure.
 - (a) Remove either the calibrated oil pressure transmitter or the pressure test assembly from its location.
 - (b) Install engine oil pressure transmitter or engine oil pressure switch as applicable.
 - (i) Assemble two new sealing rings to the unit.
 - (ii) Secure the unit with seven bolts with lubricant A applied and torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).
 - (c) Connect electrical lead plug.
- (8) Paragraph deleted.
- (9) Oil tank pressure (Ref.Fig.710).
 - (a) Disconnect live line from adapter set.
 - (b) Remove adapter set from oil tank.
 - (c) Install cover plate, (79-11-01/1-300).
- (10) Electrical harness (Ref.Fig.711).
 - (a) Disconnect Cannon plugs from control room connections.
 - (b) Secure mounting plate (71-51-01/11-110) to the engine with two wingscrews (71-51-01/11-150 and L80) and thumbnut (71-51-01/11-130).
 - (c) Mod.0L.8180 incorporated. Secure spring clips (71-51-01/l1-220 and 230) with bush (71-51-01/11-240) to bracket (71-51-01/11-250) with screw (71-51-01/11-210), washer (71-51-01/11-200), and nut (71-51-01/11-190). Torque-tighten the nut to between 25 and 30 lbf in. (2,8 and 3,4 N.m).

- (d) Connect the seven electrical harness plugs to the dummy receptacles (71-51-01/11-100).
- (e) Install harness supports (Ref.Fig.711).
 - (i) Support A. Strap the harness (71-51-01/11-10) to the electrical loom and secure the harness to the bracket (72-42-01/4-70) with a wingscrew (71-51-01/11-20).
 - (ii) Support B. Strap the electrical loom to the tube with the harness (71-51-01/ 11-30).

 - (iv) Support D. Strap the harness (71-51-01/11-40) to the electrical loom and clip around the tube.
 - (v) Support E. Strap the harness (71-51-01/11-50) to the electrical loom and secure the harness to the clamp with wingscrew (71-51-01/11-60).
- (11) Thermocouple termination junction box electrical connections (Fig.710).
 - (a) Disconnect the electrical terminals from the junction box.
- (12) LP turbine static pressure (Ref.Fig.710).

 $\underline{\text{NOTE}}$: This connection is normally only connected when trouble shooting.

- (a) Remove adapter B.451842 and union body B.376203.
- (b) Install part (SNECMA 525.293.138.0).



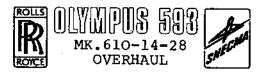
- (13) Turbine drain valve indicator (Ref. Fig. 710).
 - (a) Remove indicator from below engine and store in a safe place for future use.
- (14) Engine vents.
 - (a) Disconnect the sleeves attached to the engine hot and cold vents from the test cell extraction vents.
- (15) Jet pipe flexible drain hose.
 - (a) If required, disconnect the flexible drain hose from the jet pipe connection.
- (16) Primary nozzle air supply.
 - (a) Disconnect the air supply tubes between the slave TRA elbow and the primary nozzle control (PNC) and between the PNC and the primary nozzle actuator air jack supply manifolds. Temporarily blank the slave TRA elbow outlets.
- 8. Remove Pedestal Mounted Engine from Test Cell
 - A. Remove Air Inlet Assembly from the Engine (Ref. Fig. 706).
 - (1) Release manacle clamp securing air inlet assembly to engine.



- (2) Release left and right locking bars securing air inlet assembly to mounting platform.
- (3) Slide air intake assembly forward clear of the engine approximately 12 in. (305 mm).
- B. Remove Connecting Link (Ref.Fig.707).
 - (1) Remove link protector (Tool 2503).
 - (2) Remove five bolts and tabwashers.
 - (3) Remove anti-roll housing and disengage the connecting link from the spherical housing by rotating through 90 deg and remove from the engine.
 - (4) Remove five bolts with tabwashers securing the angular position stop and remove the stop.
 - (5) Remove spherical housings using extractor (Tool 2504).
- C. Remove Combined Reheat Jet Pipe and Primary Nozzle Assembly.

NOTE: Type 14 jet pipe has only one air supply.

- (1) Release the locking pins and using the ratchet device attached to the detuner support rail, ratchet the detuner assembly rearwards, away from the engine sufficiently to permit access to the primary nozzle and detuner approximately 12 in. (305 mm).
- (2) Place a suitable walkway between the detuner and the primary nozzle to link up with the left and right-hand walkways.
- (3) Disconnect and release the P₃ air pipe(s) union nut(s) at their connection(s) to the air jacks at the primary nozzle actuator supply ring(s), forward of the nozzle control jacks located at the eight o'clock position (viewed from the rear).
- (4) Disconnect the screech cable transducer plug from the box situated at five o'clock viewed from the rear mounted on a bracket bolted to the combustion chamber outer/exhaust diffuser case flanges.



- (5) Install resizing tool (Tool 2502) in jet pipe orifice (Ref.78-11-01).
 - CAUTION: DISTORTION OF THE JET PIPE ASSEMBLY CAN OCCUR IF THE UNIT IS ROUGHLY HANDLED.
- (6) Secure hoist to the lifting eye of a O to 4400 lb (1995 kg) torque dynamometer and attach the dynamometer to the front lifting eye of the lifting beam (Tool 2501).
- (7) Position the lifting beam over the jet pipe and primary nozzle ensuring that the adjustable linkage rod is connected to the front eyelet of the jet pipe. Adjust the turnbuckles on the tie rods to align the rear location point.
- (8) Carefully lower the beam and rest it on the jet pipe using a protective cover to prevent damage.
- (9) Transfer the dynamometer hook from the front to the rear eye of the lifting beam and insert two quickrelease pins to secure the lifting beam to the nozzle support ring.
- (10) Steadily raise the hoist and take the weight of the jet pipe ensuring that the reading on the dynamometer gauge does not exceed 1500 lb (680 kg).
 - NOTE: The free weight of nozzle and jet pipe is approximately 1500 lb (680 kg).
- (11) Release and remove the nuts/bolts securing the torque tie tubes to the left and right-hand sides of the primary nozzle support ring.
- (12) Release the locking pins and withdraw the location bars securing the primary nozzle support ring to the torque tie tubes, at the left and right-hand mounting points.
- (13) Carefully move the jet pipe and nozzle rearwards ensuring it is disengaged from the turbine exhaust diffuser and the mounting points, and that the reading on the dynamometer gauge does not exceed 1500 lb (680 kg). Lift unit clear of the engine.



- (14) Whilst the unit is suspended on the hoist, remove the four screws securing screech transducer and withdraw transducer from its housing, blank-off orifice.
- (15) Install suitable blanks to the two P3 air connections and tube ends.
- (16) Position the primary nozzle/jet pipe over the transportation trolley with the nozzle orifice facing the front.
- (17) Carefully lower the unit to align the securing bolt holes, two each side of the trolley, with the holes in the feet of the primary nozzle support ring. Insert bolts and secure with nuts. Torque-tighten nuts to between 40 and 50 lbf in. (4,5 and 5,6 N.m).
- (18) Attach outer support ring to the open end of the jet pipe and position location pads around periphery.
- (19) Slide the jet pipe to align holes on support ring brackets with the trolley frame and insert the two location bolts. Torque-tighten bolts to between 40 and 50 lbf in. (4,5 and 5,6 N.m).
- (20) Remove lifting beam from its attachment points and stow in a safe place for future use.
- D. Remove Engine from Test Cell.
 - (1) Using hoist (five ton minimum 5080 kg), position the engine lifting beam (Tool 2501) (Ref.Fig.702) over the engine and attach the four self-locking pip pins through the sling links and engine lifting eyes.
 - (2) Steadily take the weight of engine on hoist and using the beam adjuster, set sling pointer to correct position, as engine weight is taken.
 - (3) Remove the locking pin (Ref.Fig.704) and pin securing the cross beam to the mounting yoke located on the struts at the top of the air inlet case/LP compressor front flange.
 - (4) Release the cross beam capstan bolts securing the girder structure to the test bed vertical structure, and slide the cross beam forward and clear of the engine.



(5) Disconnect the sleeves locating the slave efflux pipes from the hot and cold vents beneath the engine.

NOTE: The sleeves are pushed upwards onto the engine vent pipes and are removed from the pipes after the engine has been lifted from the cell and prior to installation onto the transportation trolley.

- (6) Disconnect location pin of the centralising structure mounted on the front flange of the combustion chamber outer casing, (Ref.Fig.705), release the support beam capstan, and swing the support beam from across the engine to a position parallel with the engine. Disconnect the setting bar from its linkage.
- (7) Disconnect the main engine mounting trunnions at the three and nine o'clock positions. Remove the four allan key type bolts securing the plates over the mounting trunnions on each side of the engine and lift the top section of plates to expose the trunnions (Ref.Fig.703).

CAUTION: WHEN LIFTING ENGINE, MAINTAIN ADEQUATE CLEARANCE BETWEEN ENGINE AND JET PIPE. MAINTAIN CAREFUL WATCH FOR CATCH-UP OF LINKAGES AND TEST BED EQUIPMENT.

- (8) Lift engine away from test stand.
- (9) Remove bearing carriers, spherical balls and circlips from trunnions. Store in a safe place for future use.
- (10) Install blanks on all openings.
- (11) Position engine over transportation trolley.
- (12) Attach slave bearing carriers to the main trunnions and steadily lower engine onto the transportation trolley.
- (13) Carefully align bearing carrier mountings provided on the trolley frame and slot into position.
- (14) Align the holes of the front support links with those of the engine at the two and ten o'clock positions on the air inlet case/low pressure compressor case. Insert bolts and secure with nuts.

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- (15) Release weight of engine, disconnect the four quick-release type attachments and remove sling.
- (16) Secure the half cup attachments on right and lefthand sides of the engine main trunnions and torquetighten the four nuts to between 90 and 100 lbf in. (10,2 and 11,3 N.m). The engine is now secure for towing.
- 9. Remove Overhead Mounted Engine from Test Cell
 - A. Remove Air Inlet Assembly (Ref.Fig. 706).
 - (1) Support air inlet assembly.

NOTE: Weight of air inlet assembly is approximately 350 lb (159 Kg).

- (2) Remove manacle clamp and withdraw air inlet assembly from the engine.
- B. Remove Jet Pipe Assembly (Ref.Fig.707).
 - (1) Remove connecting link as follows:
 - (a) Remove five bolts and tabwashers and remove anti-roll housing.
 - (b) Disengage connecting link from the spherical housing by rotating through 90 deg and remove from the engine.
 - (c) Remove five bolts with tabwashers and remove: spherical housings using extractor (Tool 2504). Retain all removed parts with the engine. Discard tabwashers and install link protector (Tool 2503).
 - (2) Disconnect the connecting linkage from the jet pipe assembly.
 - (3) Unlock the jet pipe assembly from overhead rail and move the jet pipe assembly away from the engine.



- C. Remove Engine from Test Cell.
 - (1) Disconnect test services (Ref.para.7).
 - (2) Remove engine from test cell using rail system.
 - (3) Remove slave accessories (Ref.para.10).

10. Remove Slave Accessories from Engine

- A. Air Starter.
 - (1) General.

The air starter is secured to the right accessory gearbox by a quick attach/detach clamp ring. The following procedure details the removal of the air starter.

(2) Remove Air Starter (Ref.Fig.701).

CAUTION: THE WEIGHT OF THE AIR STARTER ASSEMBLY IS APPROXIMATELY 40 LB (18 KG).

- (a) Release duct clamp securing the air duct to the starter and remove. Discard the seal.
- (b) Disconnect the drain pipe from the drain adapter on the starter.
- (c) With the starter supported adequately, unscrew and withdraw the clamping bolt, together with the spherical washer, from the fixed locking trunnion.
- (d) With the starter held firmly toward the gearbox, rotate the clamp ring approximately 30 deg clockwise to disengage the coupling thread segments.
- (e) Withdraw the starter carefully, and place it in a suitable stand.
- (f) Secure blanking cover (72-63-01/3-400) to the accessory gearbox and a suitable blanking cover to the starter aperture.



11. Install Air Intake and Exhaust Covers

- A. Air Intake Cover (Ref.Fig.712).
 - (1) Retain the hooks in the fully outward position with the wingnuts lightly tightened.
 - (2) Align the cover (72-22-01/5-10) to the air intake with the air vents equidistant from the vertical centreline and press the cover in until cover seats on the intake lip.
 - (3) Engage the hooks with the intake flange. Tighten the wingnuts and wire-lock.
 - (4) Close the air vents if the engine is to be left exposed. The vents are to be open if the engine is to be enclosed in a bag.
- B. Exhaust Cover (Ref.Fig.712).
 - (1) Retain the hooks on the cover (72-54-01/7-10) in the fully outward position with the wingnuts lightly tightened.
 - (2) Align the cover to the exhaust with TOP marking at the 12 o'clock position and press the cover in until cover seats on the exhaust.
 - (3) Engage the cover hooks with the exhaust flange. Tighten and wire-lock the wingnut.

12. Electrical Test Cell and Engine Hook-up Requirements

A. General.

The following general principles relating to the electrical system are to be adhered to in the test cell to prevent damage and as an aid to troubleshooting.

(1) All cables, junction boxes and connections are to be clearly identified.



- (2) All cable ends are to have standard SBAC (SAE) type crimp blocks installed.
- (3) High voltage supply cables are to be run in separate trunking from all control, signal and instrumentation cables to prevent possible interference.
- B. Electrical Test Cell System (Ref.Fig.713).
 - (1) Electrical plugs required in the test cell are identified by numerals. Check the numeral against the provided list for the type of plug required (Table 707).
 - (2) The temperature/resistance and Tl simulated temperature tables are incorporated in table format (Ref. Table 708).

| Item | Connector | Type No. | Make |
|-----------------|-----------------|-----------------------------|---------|
| 1 | Fixed Socket | HTMA OE-28-21SV | Cannon |
| 2 3 | Fixed Socket | HTMA OE-28-21SW | Cannon |
| 3 | Fixed Socket | HTMA OE-28-21ST | Cannon |
| 4 | Fixed Socket | HTMA OE-28-21SN | Cannon |
| | Free Socket | HTMA 6F-20-27SW | Cannon |
| 5 6 7 | Free Socket | HTMA 6F-20-27S | Cannon |
| 7 | Free Socket | MS 3106-E20-295 | Cannon |
| 8 | Plug Male Shell | DPXCMA-57S-57S-57S-33B-0099 | Cannon |
| 9 | Free Plug | KJ6E-24A-1PA | Cannon |
| 10 | Fixed Socket | HTMA OE-28-21SY | Cannon |
| 11 | Plug Male Shell | DPX2MA-26S-4OS-33B-0092 | Cannon |
| 12 | Fixed Socket | HTMA OE-28-21SX | Cannon |
| 13 | Free Socket | HTMA 6F-12S-3SN | Cannon |
| $\overline{14}$ | Fixed Socket | HTMA 6F-125-3SN | Cannon |
| 15 | Free Socket | HTMA 6F-12S-3SW | Cannon |
| 16 | Fixed Socket | HTMA OE-28-21SZ | Cannon |
| 17 | Free Plug | CZ49216 | Plessey |
| 18 | Free Plug | CZ49218 | Plesse |
| 19 | Free Socket | CZ49015 | Plesse |
| 20 | Free Socket | · CZ49126 | Plesse |

Test Cell Electrical Plug Identification
Table 707



| Temp Deg C | RT OHMS | + OHMS |
|-------------|------------------|------------|
| -70 | 93.58 | 0.3 |
| - 60 | 98.83 | 0.3 |
| -40 | 109.29 | 0.3 |
| -20 | 119.68 | 0.3 |
| 0 | 130.00 | 0.3 |
| -20 | 140.26 | 0.3 |
| 40 | 150.46 | 0.3 |
| 60 | 160.60 | 0.3 |
| 80 | 170.68 | 0.5 |
| 100 | 180.70 | 0.5 |
| 120 | 190.66 | 0.5 |
| 140 | 200.56 | 0.5 |
| 160 | 210.39 | 0.5 |
| 180 | 220.17 | 0.6 |
| 200 | 229.88 | 0.6 |
| 220 | 239.54 | 0.8 |
| 240 | 249.13 | 0.8 |
| 260 | 258.67 | 0.8 |
| 280 | 268.14 | 0.9 |
| 300 | 277.55 | 0.9 |
| 320 | 286.90 | 1.0 |
| 340 | 296.20 | 1.1 |
| 360 380 | 305.43 | 1.1 |
| 400 | 314.60 323.71 | 1.1 1.2 |
| 400 | 323.11 | 1.2 |

Temperature/Resistance Table for Temperature Bulbs and Tl Simulated Temperature
Table 708

(3) Calibration of the oil quantity indicators, type ES836 and type ES1223 is to be carried out when required using a resistance box and calibration table (Ref. Table 709).

NOTE: Type ES1223 must be switched to OLY.610 before performing calibration.

(4) Electrical harness loom connections are identified at the engine break position by letters within circles.

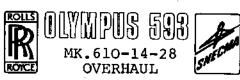
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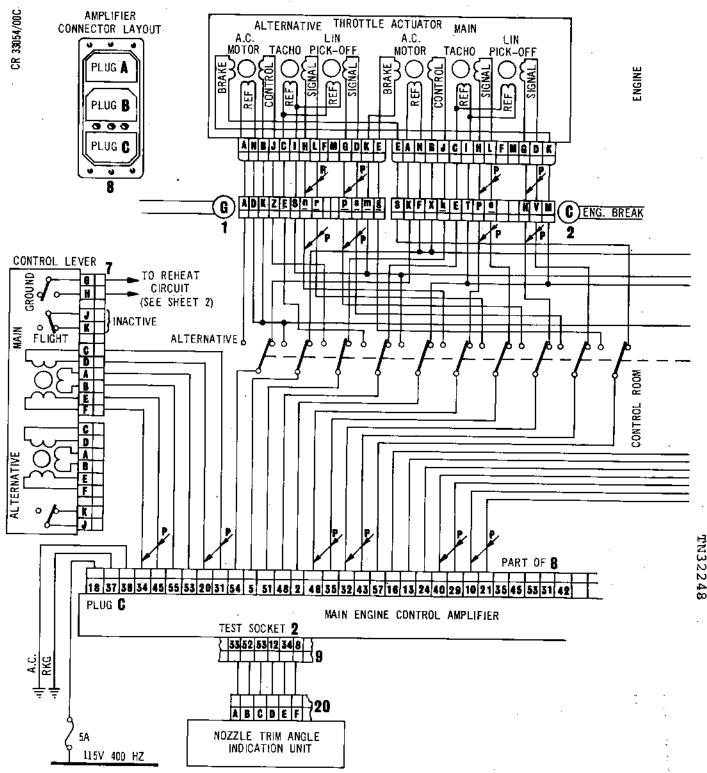
| Percent | Resistance Box (Ohms) |
|--|---|
| 0 6.6 13.3 20.0 26.6 33.3 40.0 46.6 53.3 | 0 150 300 450 600 750 900 1050 1200 1350 |
| 66.6 73.3 80.0 86.6 93.2 100 Overfull | 1500 1750 1800 1950 2100 2250 3070 |

Engine Oil Quantity Indicator Calibration Table 709



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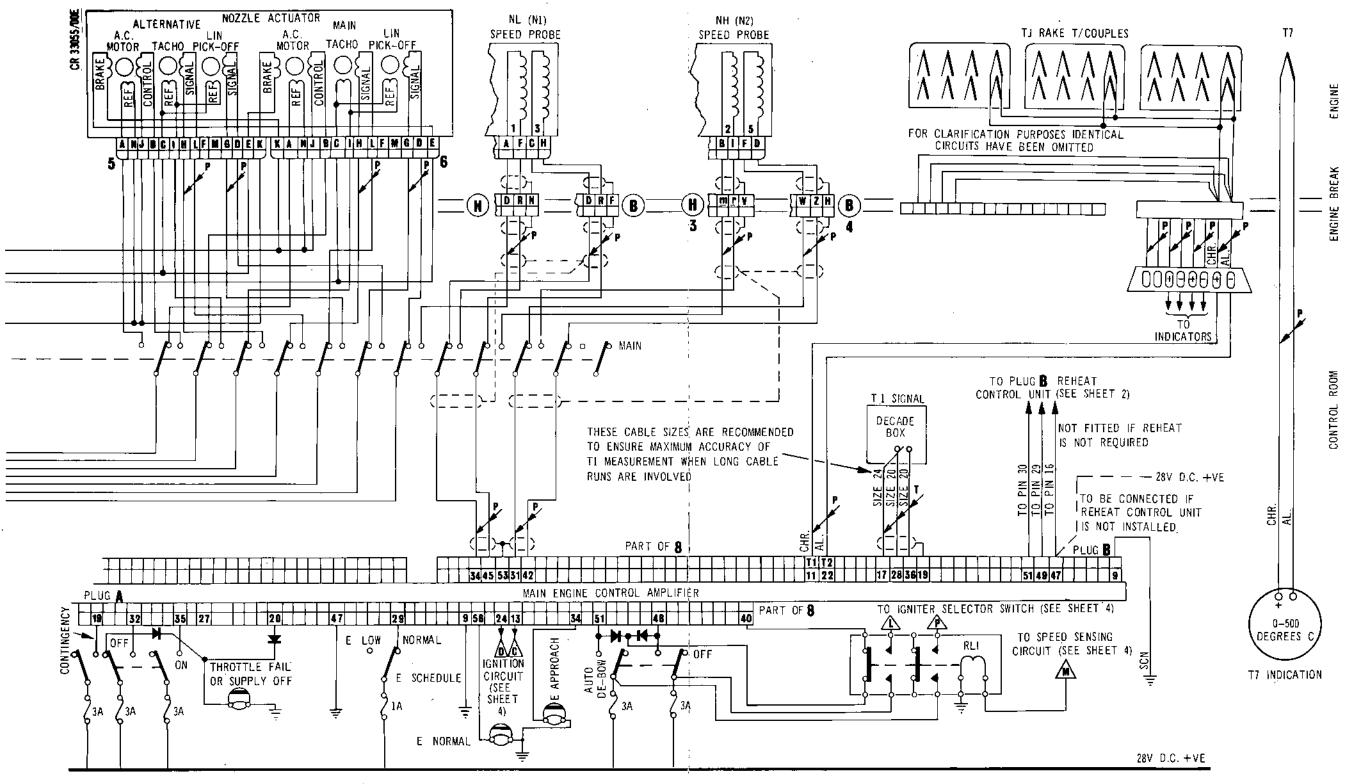




Test Cell Electrical Connections Figure 713 (Sheet 1 LH)

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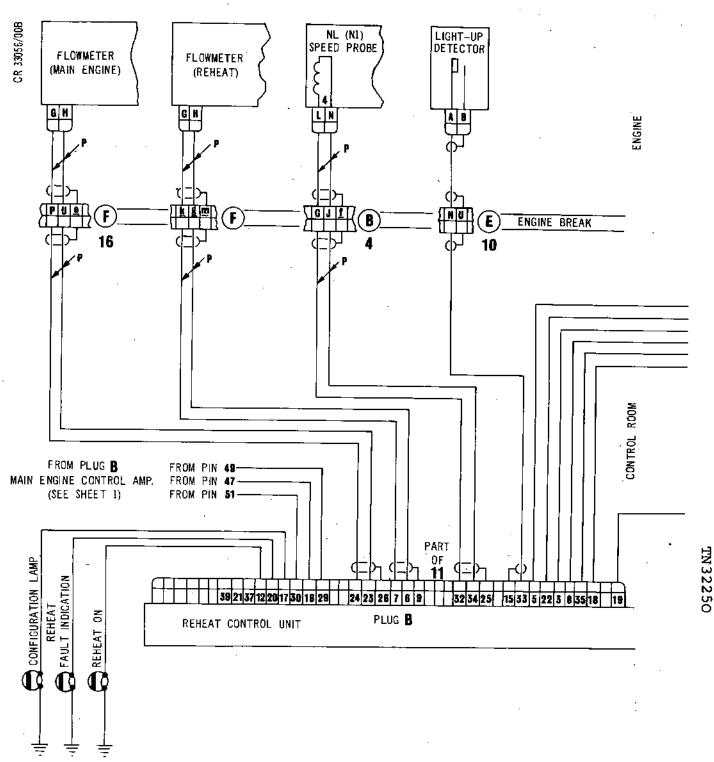
Test Cell Electrical Connections Figure 713 (Sheet 1 RH)

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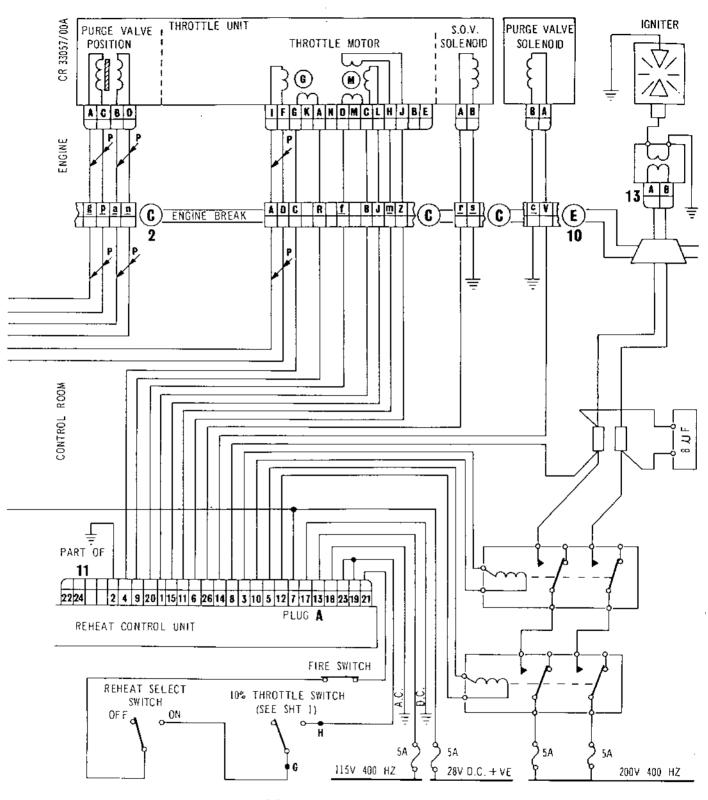
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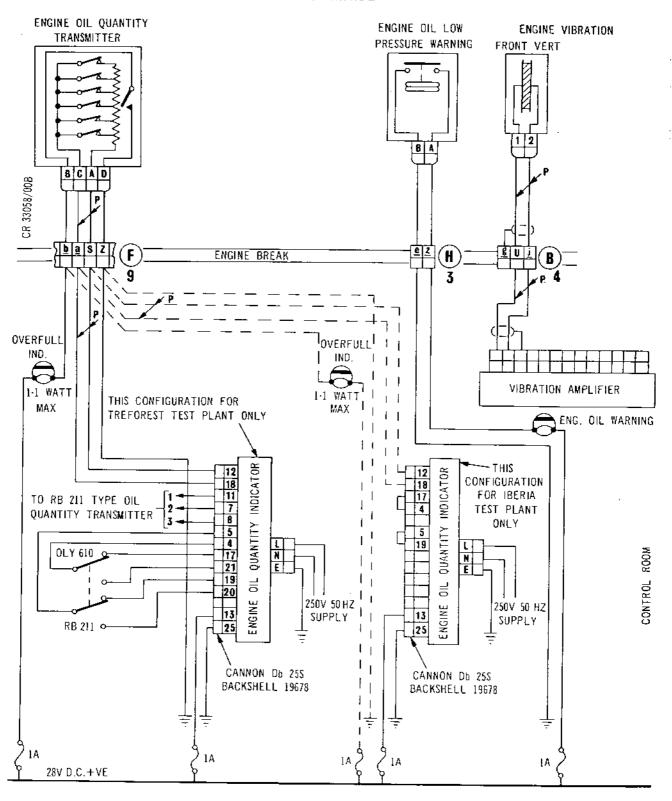
Test Cell Electrical Connections Figure 713 (Sheet 2 LH)

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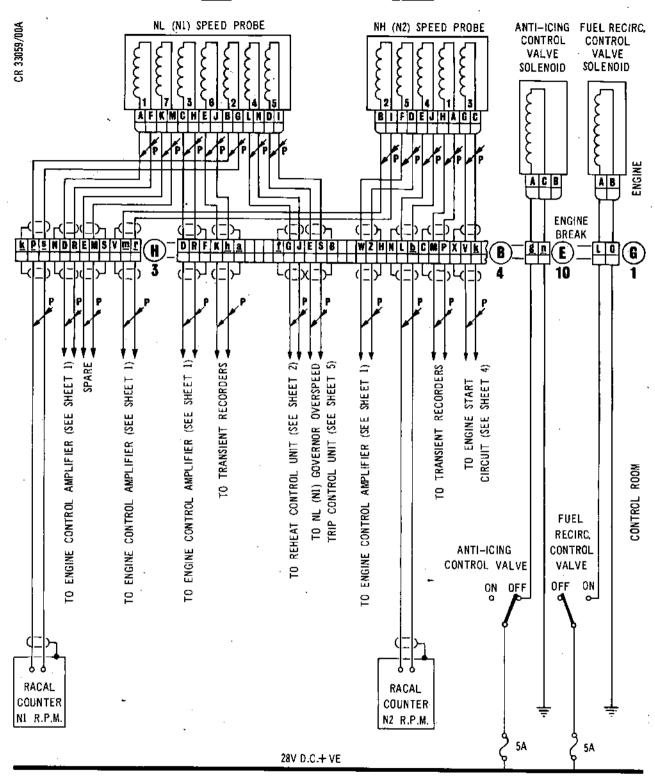
Test Cell Electrical Connections Figure 713 (Sheet 2 RH)

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Test Cell Electrical Connections Figure 713 (Sheet 3 LH)

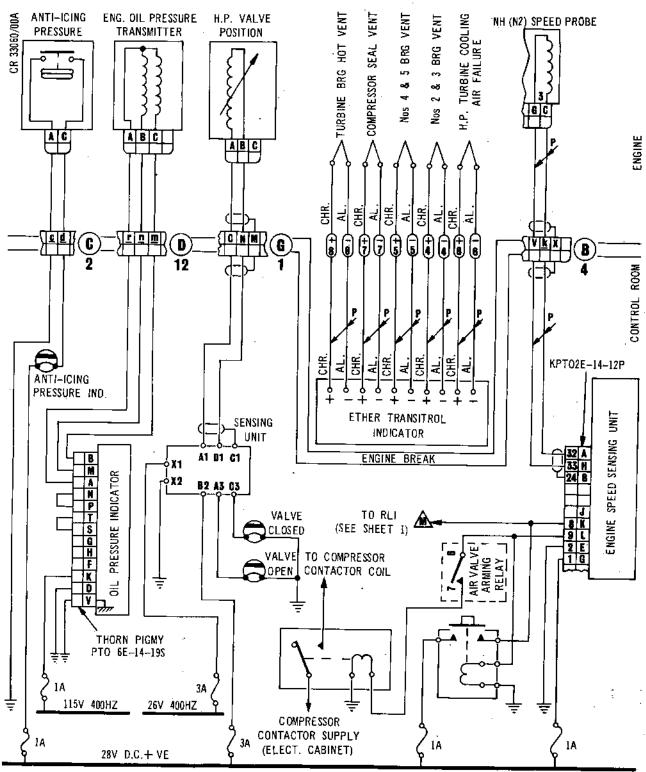
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Test Cell Electrical Connections Figure 713 (Sheet 3 RH)

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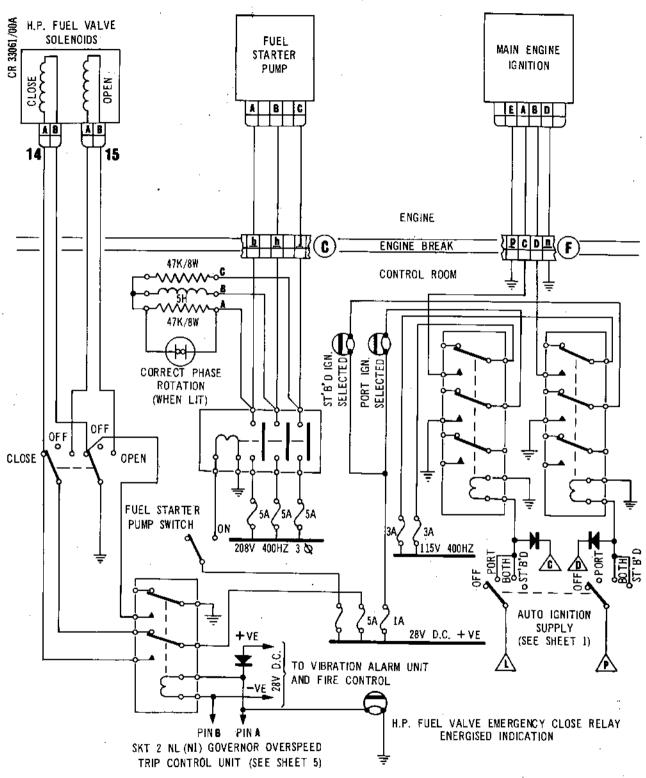




Test Cell Electrical Connections Figure 713 (Sheet 4 LH)

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Test Cell Electrical Connections Figure 713 (Sheet 4 RH)

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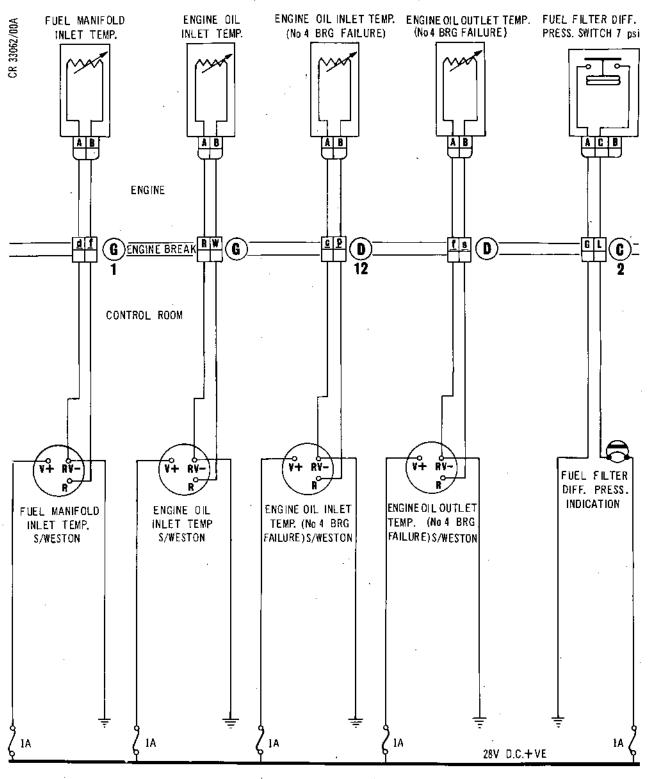
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OLYMPUS 593

OVERHAUL



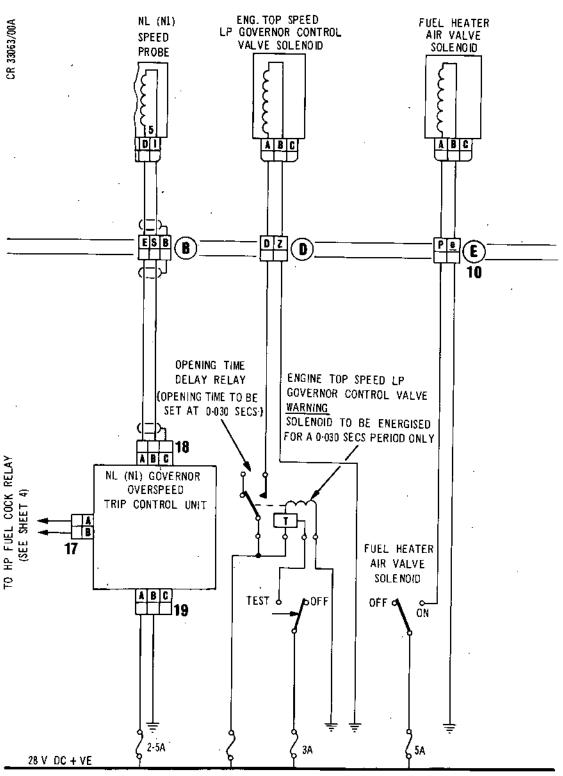


Test Cell Electrical Connections Figure 713 (Sheet 5 LH)

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Test Cell Electrical Connections Figure 713 (Sheet 5 RH)

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PROCEDURES AND ADJUSTMENTS - ENGINE TESTING

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PROCEDURES AND ADJUSTMENTS - ENGINE TESTING

1. General

- A. This section details the procedures required to service and prepare an engine prior to testing and any engine adjustments that may be required as indicated by the testing.
- B. Special tools quoted in this section shall normally be identified by their Ref.No. e.g. (Tool 1234). For a complete list of tooling required for engine testing and for Manufacturers Part No., refer to Special Tools, Fixtures and Equipment, Table 1001. Tools required for component overhaul and also for testing will be identified by the makers name and Part No.
- C. Consumables quoted in this section are listed in 72-00-24, Engine Testing General. Nomenclature will be identified using the item letter, e.g. Apply lubricant 'B' to the threads .
- D. Although the functional check of the reheat system is not mandatory, the manufacturers strongly recommend that the testing be carried out to ensure correct functioning of the reheat system. Where applicable, the reheat system checks have been incorporated in this section.

2. Procedure for Rectifying Leaks

- A. Tube End Fittings.
 - (1) Where leaks occur from tube end fittings and flanges, torque-tightening of flange bolts and tube end fittings should not be carried out until an examination of the end fitting has been completed. Reject either component if damaged.
 - (2) Where a tube has a sealing ring as a method of sealing, renew the sealing ring and tighten the union nut or mounting flange, as applicable.
 - (3) When a leak from a seal failure drains system connection on a component is disclosed, rectification may be accomplished by the renewal of a defective seal plate. The removal and installation of a seal plate is given as a standard practice in 72-00-35, Trouble Shooting. The work is considered as being done during the course of a pressure test.

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- 3. Servicing of Engine and Components Lubrication Systems
 - A. Initial Servicing of Engine Oil System (Ref.Fig.702).
 - (1) Detach fill/drain coupling pressure cap assembly. Turn locking ring and pull it downward to release locking-balls of quick release coupling.
 - (2) Connect delivery hose of re-oiling equipment (Tool 2505) containing the approved engine oil to the fill/drain coupling. On initial installation, deliver 26 U.S. quarts of oil to the tank in quantities of 5 U.S. quarts at a time and record the oil tank contents on the oil tank contents indicator at each step. Check that the OVERFILL warning light illuminates at (approx.) 17.5 U.S. quarts level.

NOTE: The warning light will extinguish during first engine start or motoring cycle as the oil is distributed to the gearboxes.

- (3) Disconnect re-oiling hose and assemble quick release pressure cap to coupling. Ensure that sleeve is in locked position and cap is secure.
- B. Replenishment of Engine Oil Tank (Ref.Fig.702).

WARNING: AVOID CONTACT WITH HOT OIL SPILLAGE. SEVERE BURNS CAN RESULT.

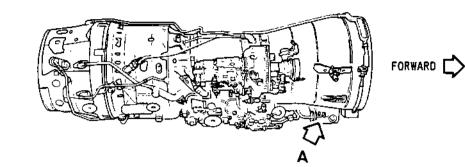
- (1) Detach fill/drain coupling pressure cap assembly. Turn locking ring and pull it downward to release locking balls of quick-release coupling.
- (2) Connect adapter hose (Tool 2505) of re-oiling equipment, containing the approved engine oil, to the fill/ drain coupling and replenish the tank as follows:
 - (a) Press dipstick into housing, rotate one-quarter turn and allow spring pressure to eject dipstick.

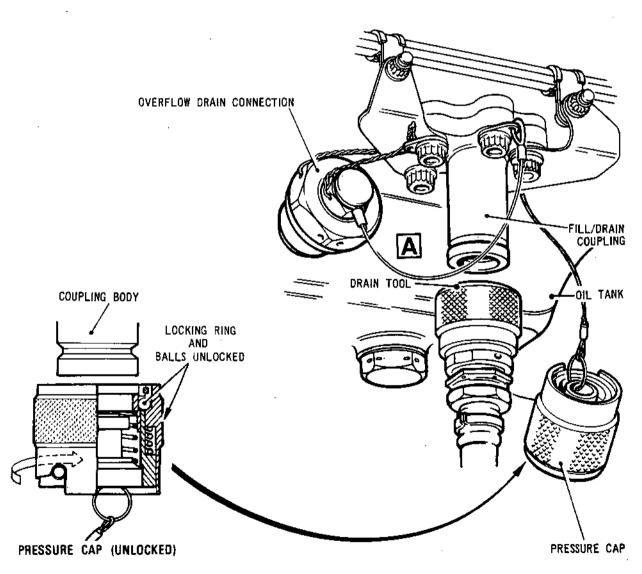
NOTE: Use slow smooth movements when raising or lowering the dipstick.

(b) Ensure that dipstick graduation, when it aligns with mark on bracket, is commensurate with oil quantity in tank.

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Oil Tank Connections Figure 702

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- (c) Introduce oil into tank until dipstick registers 14 U.S. quarts. This is the normal full level.
- (d) Raise the dipstick and press into housing, turn one-quarter turn to lock.
- (e) Disconnect the delivery hose and install the pressure cap to the fill coupling. Ensure that the sleeve is in the locked position and the cap is secure.
- C. Replenishment of the Air Turbine Starter Motor Oil System (Ref.Fig.703).

NOTE: The following procedure need only be carried out when an air starter unit has been drained of oil.

- (1) Remove the combined oil level/filler plug on the left-hand side of starter and ensure oil level is at correct level.
- (2) To replenish oil of air turbine starter motor, fill to level of plug orifice with approved oil (Ref.72-00-24, Table 703).
- (3) Install and torque-tighten plug to between 120 and 130 lbf in. (13,6 and 14,7 N.m) and wire-lock.
- D. Replenishment of the Primary Nozzle Trim Unit Oil System (Ref.Fig.704).

NOTE: To facilitate access for replenishment, two oil level/filler plugs are provided on each side of nozzle trim unit.

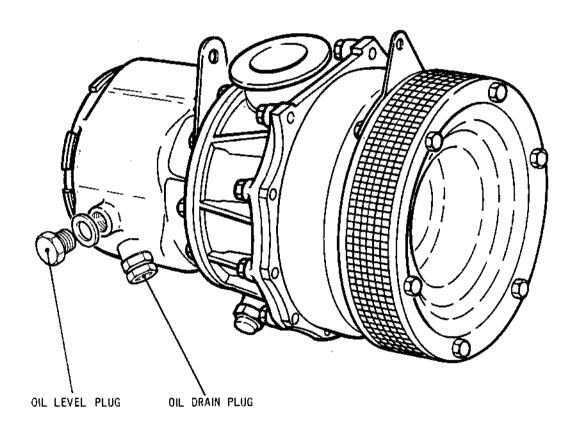
- (1) Remove level/filler plug.
- (2) If necessary, use a syringe (Tool 2506) and tube (Tool 2507) and replenish with approved oil (Ref.72-00-24, Table 703) through the level/filler plug location.

NOTE: Whenever a different brand of oil is to be used, the unit must be subjected to the oil change procedure.

(3) Renew the seal washer, apply lubricant 'A', and install the level/filler plug. Torque-tighten the plug to between 255 and 260 lbf in. (28,8 and 29,4 N.m).

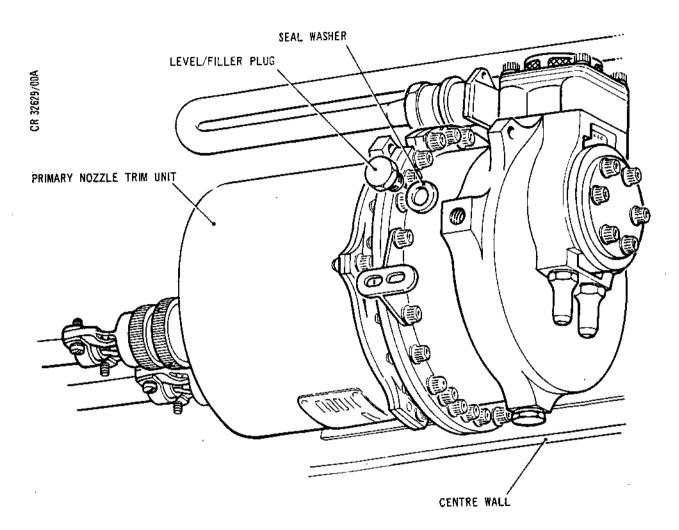
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Replenishing Air Starter Oil Level Figure 703

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Replenishing Primary Nozzle Trim Unit Oil Level Figure 704

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4. Fuel System Air Bleed (Ref.Fig.705)

NOTE: Two air bleed valves are provided. One valve bleeds the inlet elbow and first stage pump section, and the other bleeds the main fuel system including the fuel cooled oil cooler.

- A. Complete the Following Procedure.
 - (1) Ensure that all fuel connections are secure.
 - (2) Connect the air bleed tube assembly (Tool 2508) to the air bleed valve on the distribution dump valve. Direct the end of the pipe into a container.
 - (3) Check that the HP fuel valve is in the 'CLOSED' position.
 - (4) Open the LP fuel valve.
 - (5) Start the fuel tank backing pumps.
 - (6) Bleed all air from the system through the air bleed valve. When fuel flows free of air, close the bleed valve securely and remove air bleed tool assembly.
 - (7) With fuel tank backing pump still on, check for leaks at the air bleed and drain valve positions. No leaks are acceptable.
 - (8) On satisfactory completion of check, switch off the fuel tank backing pump and close the LP fuel valve.
 - (9) Assemble the blank to the air bleed valve with a serviceable seal. Tighten and wire-lock the cap.

5. Reheat Ignition Supply Check

A. With the igniter operating, ensure that the current consumption for normal operation is between 3A and 6A and that there is no excessive voltage drop.

6. Pre-running Engine Checks

- A. Perform the following checks before attempting to start the engine after installation in the test cell.
 - (1) General check for external damage and any obviously loose or insecure fittings.

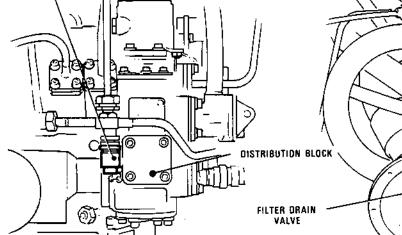
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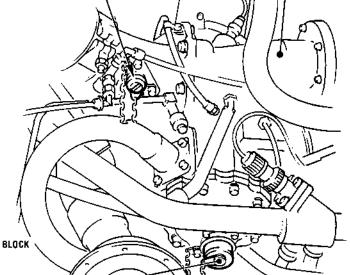
INLET ELBOW ORAIN VALVE











Bleeding Air from the Fuel System Figure 705

FIRST STAGE FUEL PUMP



- (2) Examine any visible blading for damage or foreign bodies.
- (3) Rotate engine to check for freedom of LP compressor/ turbine.
- (4) Ensure that the starter is fitted and locked correctly.
- (5) Check security of mounting trunnions and nozzle alignment.
- (6) Check connection of all controls and instrumentation harness plugs.
- (7) SOV solenoid for operation.
- (8) Check anti-icing valve solenoid for operation.
- (9) Check fuel recirculation solenoid for operation.
- (10) Check warning system for operation.
- (11) Check fuel heater valve solenoid operation.
- (12) Carry out fuel leakage checks at 30 psig minimum backing pump pressure with the SOV closed and the starter pump OFF.
 - (a) Maximum allowed leakage into the drains tank is 10 cc/minute.
 - (b) Maximum allowed leakage into the engine is NIL.

7. Transformer Ratio Test

A. This test is to be performed when an ignition defect is suspected. Refer to Troubleshooting 72-00-35.

8. Engine Adjustments

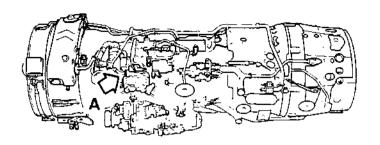
- A. Main Oil Pump Relief Valve Adjustment (Ref.Fig.706).
 - (1) General.

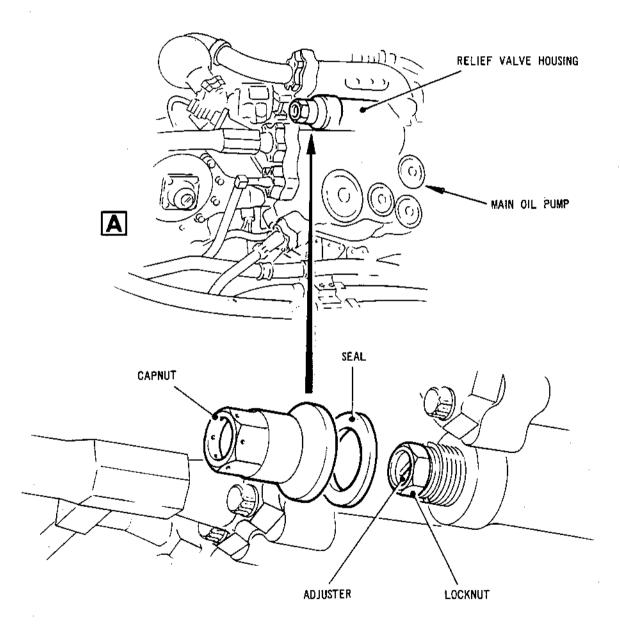
The system operating pressure is controlled by a relief valve housed in the base of the main oil pump in the left-hand gearbox. The relief valve is adjustable and any adjustment must be carried out with the engine stationary.

- (2) Adjustment Procedure.
 - (a) Remove capnut.

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Main Oil Pump Relief Pressure Adjustment Figure 706

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- (b) Loosen the locknut a few turns.
- (c) Adjust the oil pressure setting as required by using a broad bladed screwdriver on the adjuster. Clockwise will increase the pressure and counter-clockwise will decrease the pressure. One full turn will alter the pressure by approximately 4 psi.
- (d) After adjustment, torque-tighten locknut to between 170 and 190 lbf in. (19,2 and 21,5 N.m) with lubricant 'A' applied.
- (e) Ensure seal is positioned in the recess of the capnut, assemble capnut to relief valve and torque-tighten to between 170 and 190 lbf in. (19,2 and 21,5 N.m) with lubricant 'A' applied and wire-lock.
- B. H.P. Overspeed Governor N2 Depressed Datum Check (Fuel System).
 - (1) General.

A special tool is used to unlock the adjusting screw housing and allow the governor spring to expand hence reducing the load applied in opposition to the centrifugal component of the governor. With the datum reset in this position, the special tool is automatically prevented from becoming disengaged. Removal of the tool automatically resets the unit in the high datum position for normal engine operation.

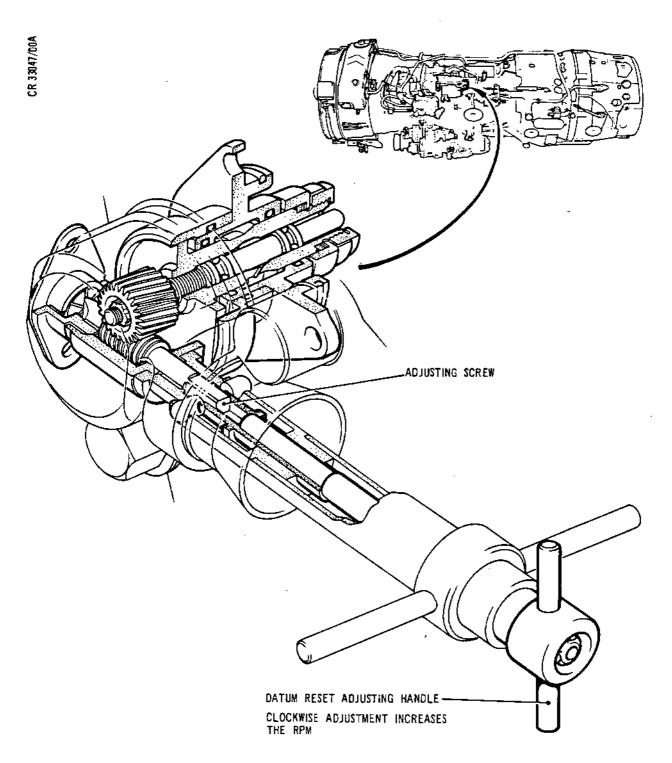
- (2) Adjustment.
 - (a) Using the central part of the combination reset tool (Tool 2509), adjust the datum reset adjusting screw.
 - (b) The adjusting screw has a left-hand thread; clockwise adjustment will increase the rpm. One turn is equal to approximately 27 rpm.

9. <u>Oil Draining</u>

A. General.

When only one gearbox requires to be drained, comply with the procedure detailed in either paragraph B or paragraph C appropriate to the gearbox affected and then complete the servicing procedure.

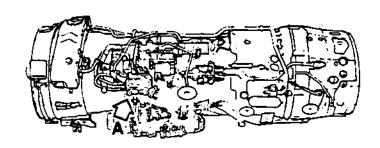
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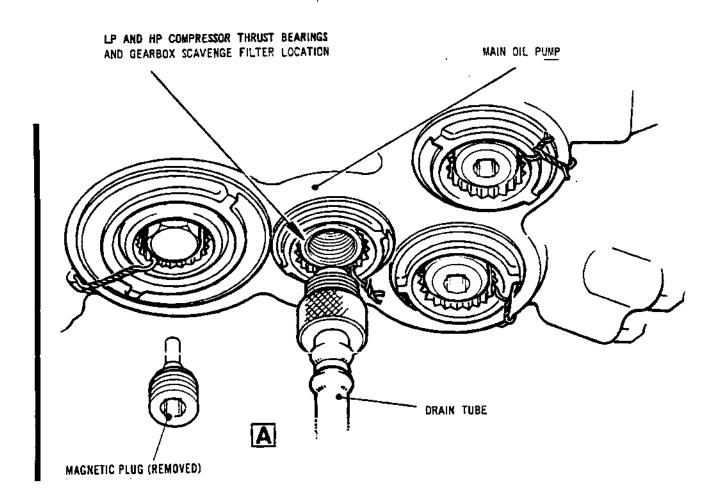


 N_2 Overspeed Governor Adjustment Figure 707

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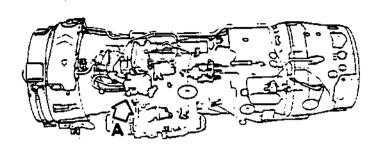


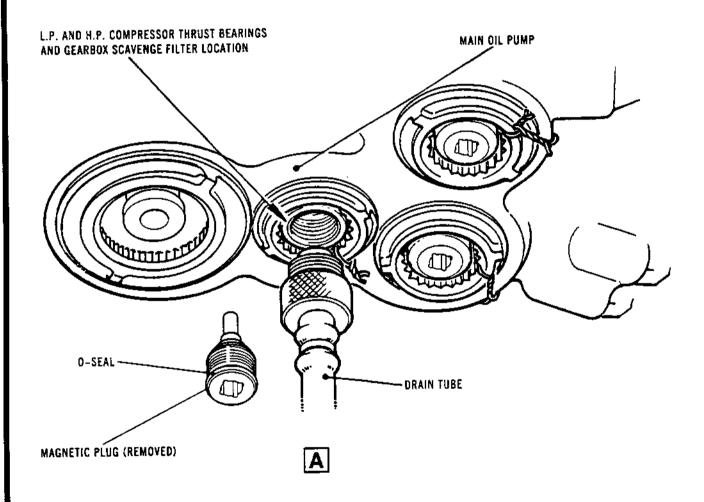


Left-hand Gearbox Oil Draining (Pre SB.OL.593-72-9036-419) Figure 708

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Left-hand Gearbox Oil Draining (SB.OL.593-72-9036-419) Figure 708A

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- B. Drain Oil from Left-Hand Gearbox (Ref.Fig.708)
 - (1) Position container below main oil pump.
 - (2) Remove screwed magnetic plug assembly from the drain valve and body assembly installed at the LP and HP compressor thrust bearings and gearbox scavenge strainer locations.

CAUTION: USE ONLY THE APPROVED DRAIN TOOL.

(3) Direct drain tube end into container and screw drain adapter (Tool 2510 or 3153) into drain valve and body assembly. This action opens valve.

NOTE: Use Tool 2510 on engines Pre.SB.OL.593-72-9036-419 standard, and Tool 3153 on engines to SB.OL.593-72-9036-419 standard.

(4) When oil ceases to drain, remove drain tube. Record quantity of oil drained.

CAUTION: IT IS OF THE UTMOST IMPORTANCE TO ENSURE THAT ALL MAGNETIC PLUG ASSEMBLIES ARE FULLY TORQUE TIGHTENED ON ASSEMBLY, ALSO, WHEN FITTING ASSEMBLIES MODIFIED TO SB.OL.593-72-9036-419 STANDARD A SERVICEABLE 'O' SEAL MUST BE FITTED. FAILURE TO DO THIS CAN RESULT IN OIL LEAKAGE IN FLIGHT WHICH MAY NOT BE APPARENT DURING GROUND CHECKS/RUNNING.

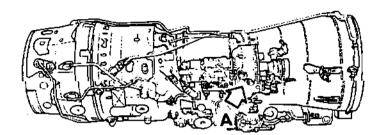
(5) Install screwed magnetic plug assembly.

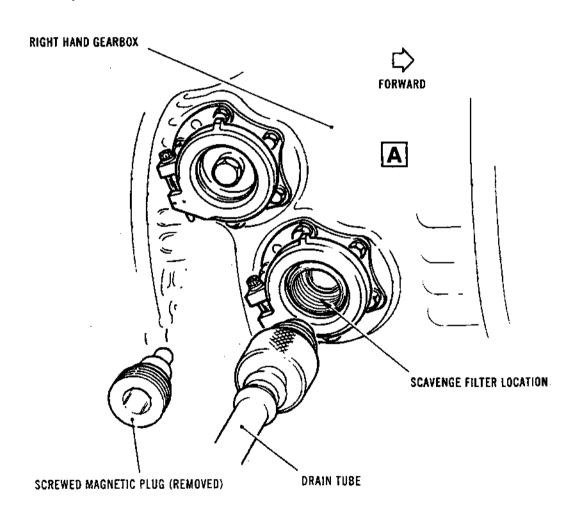
<u>NOTE:</u> A spring ring locking device housed in the drain valve body is effective during the final half turn of tightening of the screwed plug.

- (a) Apply lubricant 'A' and screw plug in drain valve and body assembly.
- (b) Torque-tighten plug assembly to between 230 and 250 lbf in. (26,0 and 28,2 N.m).
- C. Drain Oil from Right-hand Gearbox (Ref.Fig.709).
 - (1) Position container below right-hand gearbox oil scavenge filter location.

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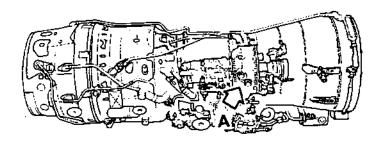




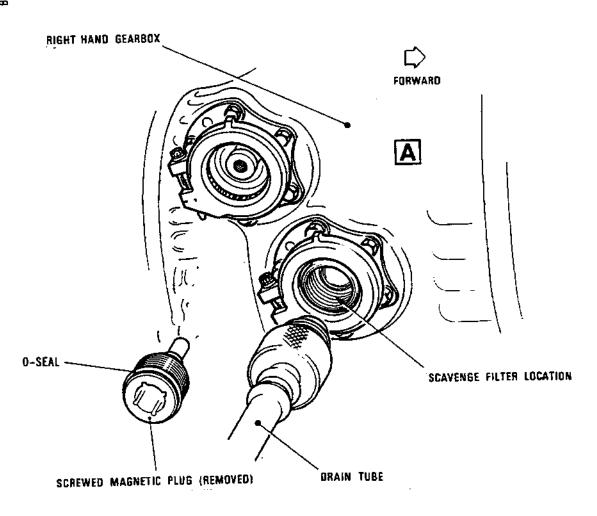
Right-hand Gearbox Oil Draining (Pre SB.OL.593-72-9036-419) Figure 709

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Right-hand Gearbox Oil Draining (SB.OL.593-72-9036-419) Figure 709A

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- (2) Remove screwed magnetic plug assembly from the drain valve and body assembly installed at the right-hand gearbox oil scavenge filter location.
- (3) Prepare the magnetic plug for inspection/check as detailed (Ref.Para.12).

CAUTION: USE ONLY THE APPROVED DRAIN TOOL.

(4) Direct drain tube end into container, remove cap from drain adapter then screw adapter (Tool 2510 or 3153) into drain valve and body assembly. This action opens valve.

NOTE: Use Tool 2510 on engines Pre.SB.OL.593-72-9036-419 standard, and Tool 3153 on engines to SB.OL.593-72-9036-419 standard.

(5) When oil ceases to drain, remove drain tube. Record quantity of oil drained.

CAUTION: IT IS OF THE UTMOST IMPORTANCE TO ENSURE THAT ALL MAGNETIC PLUG ASSEMBLIES ARE FULLY TORQUE TIGHTENED ON ASSEMBLY, ALSO, WHEN FITTING ASSEMBLIES MODIFIED TO SB.OL.593-72-9036-419 STANDARD A SERVICEABLE 'O' SEAL MUST BE FITTED. FAILURE TO DO THIS CAN RESULT IN OIL LEAKAGE IN FLIGHT WHICH MAY NOT BE APPARENT DURING GROUND CHECKS/RUNNING.

(6) Install magnetic plug assmebly.

NOTE: A spring ring locking device housed in the drain valve body is effective during the final half turn of tightening of the magnetic plug.

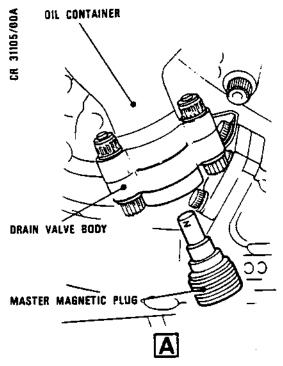
- (a) Apply lubricant 'A' and screw plug in drain valve and body assembly.
- (b) Torque-tighten plug assembly to 30 lbf ft. (40 N.m).
- 10. Magnetic Plug Removal and Installation (Ref.Fig.710)
 - A. General.

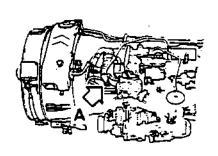
Magnetic plugs are installed in the right-hand gearbox and in the oil container of the return tube, oil pump to oil cooler. The following procedure applies to either plug.

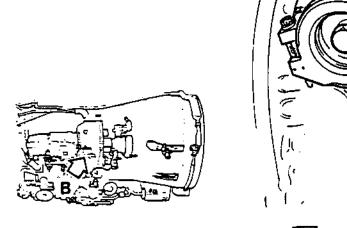
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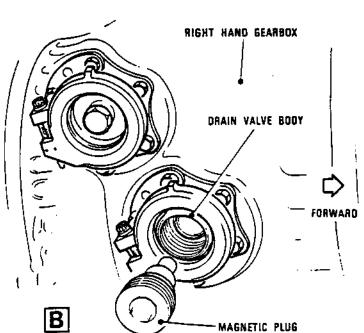
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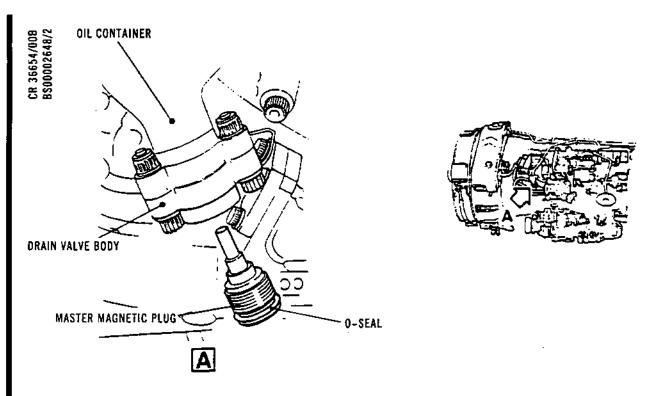


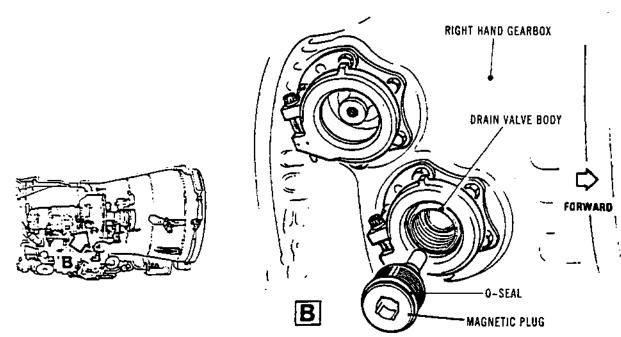
Magnetic Plugs and Location Detail (Pre SB.OL.593-72-9036-419) Figure 710

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Magnetic Plugs and Location Detail (SB.OL.593-72-9036-419)
Figure 710A

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- B. Remove Magnetic Plug.
 - (1) Wipe magnetic plug and surrounding area clean.
 - (2) Unscrew and remove magnetic plug and ensure that selfsealing valve in drain valve is correctly seated.
 Take care that any debris adhering to the magnetic
 probe is not dislodged. Place a protective plastic
 sleeve over the magnetic portion of the plug, again
 ensuring that any adhering debris is not dislodged.
 - (3) Attach a label to the plug containing details of location from which plug has been removed and the engine number.
 - (4) Place plug in a clean container and forward for inspection as detailed (Ref.para.12).

CAUTION: ENSURE THAT MAGNETIC PROBE IS PROTECTED FROM EXTERNAL CONTAMINATION AND ISOLATED FROM FERROUS METAL AND OTHER MAGNETIC PLUGS.

C. Install Magnetic Plug.

CAUTION: IT IS OF THE UTMOST IMPORTANCE TO ENSURE THAT ALL MAGNETIC PLUG ASSEMBLIES ARE FULLY TORQUE TIGHTENED ON ASSEMBLY, ALSO, WHEN FITTING ASSEMBLIES MODIFIED TO SB.OL.593-72-9036-419 STANDARD A SERVICEABLE 'O' SEAL MUST BE FITTED. FAILURE TO DO THIS CAN RESULT IN OIL LEAKAGE IN FLIGHT WHICH MAY NOT BE APPARENT DURING GROUND CHECKS/RUNNING.

NOTE: A spring ring locking device housed in the drain valve body is effective during the final half turn of tightening of the magnetic plug.

- (1) Apply lubricant 'A' to plug then screw plug into its location.
- (2) Torque-tighten magnetic plug to 30 lbf ft. (40 N.m).

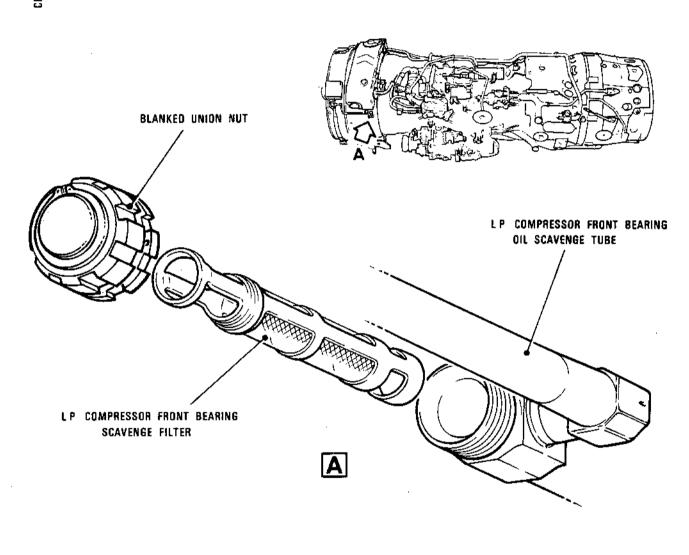


11. Oil Filter Removal and Installation

- A. General.
 - (1) The following paragraphs detail the removal, preparation for inspection and installation of the pressure feed filters and scavenge filters. Paragraph B deals with the LP compressor front bearing scavenge filter, paragraph C with the three scavenge filters which are installed in a similar manner in the main oil pump, and paragraph D with the scavenge filter in the right-hand gearbox. The pressure filter of the right-hand gearbox is dealt with in paragraph E and the main oil pump pressure filter in paragraph F.
- B. LP Compressor Front Bearing Scavenge Filter (Ref. Fig. 711).
 - (1) Remove filter.
 - (a) Clean union nut and surrounding area of filter location.
 - (b) Position container under filter location to catch oil drainage.
 - (c) Fold filter paper to form a cone of similar angle to that of funnel, insert filter paper into funnel and assemble funnel to container. Mark filter paper with engine number and filter position.
 - (d) Remove union nut from filter location.
 - (e) Withdraw filter unit and place in filter paper together with union nut. Allow oil to drain into container.
 - (f) Carry out filter inspection and processing (Ref. para.12).
 - (g) Measure and record the quantity of oil drained from the system.
 - (2) Install filter.
 - (a) Insert filter unit into its location, element end inward.



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LP Compressor Front Bearing Scavenge Filter and Location Detail Figure 711

TESTING

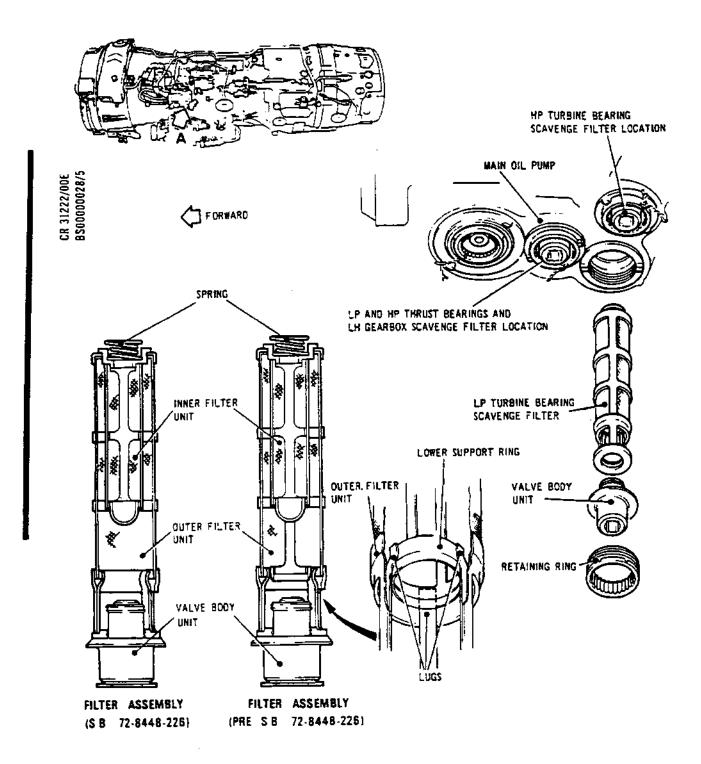
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- (b) Ensure that blanking ferrule and circlip are correctly assembled to union nut and apply lubricant 'A'. Assemble blanked union nut to filter housing.
- (c) Restrain filter housing against turning and torque-tighten nut to 500 lbf in. (56 N.m).
- (d) Wire-lock nut to oil tube elbow.
- C. LP and HP Compressor Thrust Bearings and LH Gearbox Scavenge Filter, LP Turbine Bearing Scavenge Filter and HP Turbine Bearing Scavenge Filter (Ref.Fig.712).

NOTE: Procedure given applies to each of the above filters to pre SB. and SB.72-27 standard.

- (1) Remove filter.
 - (a) Drain oil from left-hand gearbox as detailed (Ref.para.9).
 - (b) Clean valve body unit and surrounding area of filter location.
 - (c) Position container under filter location to catch oil drainage.
 - (d) Fold filter paper to form a cone of similar angle to that of funnel, insert filter paper into funnel and assemble funnel to container. Mark filter paper with engine number and filter position.
 - (e) Unscrew and remove retaining ring then withdraw valve body unit and filter assembly. Allow oil to drain into container.
 - (f) Withdraw inner filter unit from outer filter unit and detach spring. Unscrew valve body unit from outer filter unit then place all items in filter paper.
 - (g) Carry out filter inspection and processing (Ref. para.12).
 - (h) Measure and record the quantity of oil drained from the system.



Main Oil Pump Scavenge Filters and Location Detail Figure 712

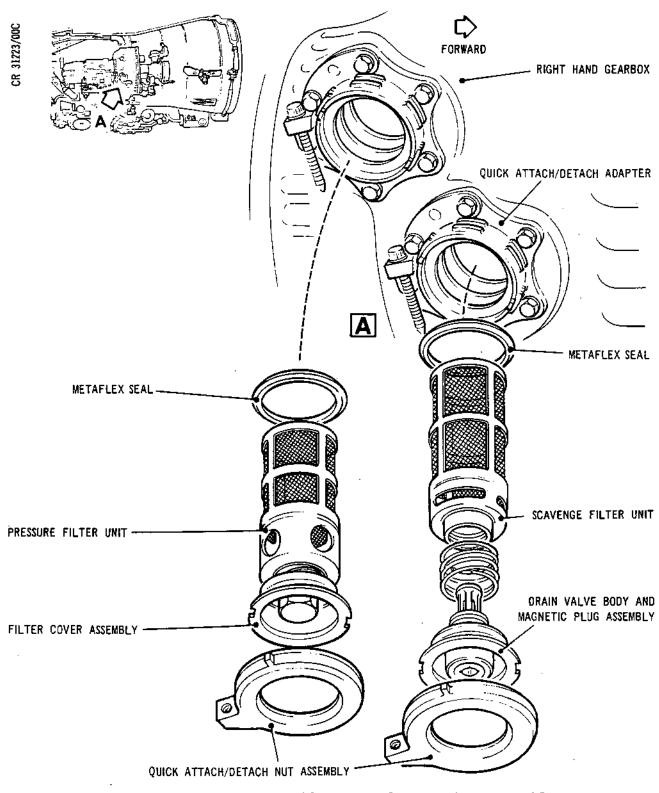
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(2) Install filter.

CAUTION: ENSURE THAT FILTER UNIT IS FULLY ASSEMBLED TO VALVE BODY UNIT.

- (a) Screw outer filter unit onto valve body unit until all its thread has entered the undercut provided.
- (b) Assemble spring to inner filter unit ensuring that it is fully engaged.
- (c) Assemble inner filter unit to outer filter unit (Ref.Fig.712).
 - (i) On engines to SB.72-8448-226 standard, assemble inner filter unit centrally into outer filter unit.
 - (ii) On engines to pre SB.72-8448-226 standard, assemble inner filter unit centrally into outer filter unit and locate the lower support ring of inner filter unit inside the three lugs of the outer filter unit.
- (d) Apply lubricant 'A' to retaining ring.
- (e) Install filter assembly in its location and secure in position with retaining ring and torque-tighten to between 720 and 840 lbf in. (81,5 and 95 N.m).
- (f) Wire-lock retaining ring to pump casing and valve body unit to retaining ring.
- D. Right-hand Gearbox Scavenge Filter (Ref.Fig.713).
 - (1) Remove filter.
 - (a) Clean area of filter location.
 - (b) Drain oil from right-hand gearbox as detailed (Ref.para.9).





Right-hand Gearbox Filters and Location Detail Figure 713

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- (c) Fold filter paper to form a cone of similar angle to that of funnel, insert filter paper into funnel and assemble funnel to container.

 Mark filter paper with engine number and filter position.
- (d) Position container under filter location to receive filter items and residual oil drainage.
- (e) Release drain valve and magnetic plug assembly quick attach/detach nut assembly.
 - (i) Unscrew and remove bolt and spherical washer from locking trunnion.
 - (ii) Use the approved drift against flat face of lug and drive nut assembly in direction to separate locking trunnions until loosened.
 - (iii) Turn nut assembly until threads disengage and align with their withdrawal slots. Remove nut assembly.
- (f) Withdraw drain valve and magnetic plug assembly, filter unit and sealing ring, squarely from gearbox. Allow oil to drain into container.
- (g) Separate filter unit, spring and drain valve and magnetic plug assembly by unscrewing filter from valve body. Place items in filter paper.
- (h) Carry out filter inspection (Ref.para.12).
- (j) Measure and record the quantity of oil drained from the system.
- (2) Install filter.
 - (a) Ensure that quick attach/detach nut assembly components are serviceable.

CAUTION: ENSURE THAT FILTER UNIT IS FULLY ASSEMBLED TO DRAIN VALVE AND MAGNETIC PLUG ASSEMBLY.



- (b) Assemble filter unit to drain valve body.
 - (i) Position spring on drain valve body.
 - (ii) Screw filter unit onto drain valve until all its thread has entered the undercut provided.
 - (iii) Check spring action.
- (c) Apply lubricant 'A' to quick attach/detach nut assembly threads and abutment flanges, and to clamping bolt, spherical nut and washer.

CAUTION: ENSURE THAT SEAL AND ADAPTER ARE TO SAME SERVICE BULLETIN STANDARD.

(d) Ascertain whether the gearbox mounted QAD adapter is to pre SB.72-7 or SB.72-7 standard and assemble a serviceable Metaflex seal of the same standard, to the adapter groove.

NOTE: Metaflex seals to SB.72-7 standard incorporate one and a half loose turns of stainless steel wrapper positioned around the outer circumference. This area is not laminated with asbestos and is not spot welded. Seals of this type must not be mistakenly rejected for spot weld failure in this area.

- (e) Insert filter with drain valve and magnetic plug assembly into quick attach/detach adapter on gearbox ensuring that slots in drain valve flange engage lugs on adapter.
- (f) Hold drain valve flange hard against seal through base of quick attach/detach nut assembly and engage threads of nut assembly with those of threaded flange as far as possible by hand.

CAUTION: ENSURE THAT THREADS HAVE ENGAGED FREELY BEFORE APPLYING TIGHTENING FORCE TO NUT ASSEMBLY.

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- (g) Position spherical washer on clamping bolt then insert bolt through fixed locking trunnion to engage threads of spherical nut of nut assembly trunnion by hand. Screw in clamping bolt and check that the locking (run-down) torque is within limits 3 to 10 lbf in. (0,3 and 1,1 N.m).
- (h) Tighten and lock nut assembly.
 - (i) Ensure that nut assembly is hand-tight.
 - (ii) Torque-tighten clamping bolt to 60 lbf in.
 (6,8 N.m).
- (j) Finally tighten clamping bolt.
 - (i) Slacken bolt and ensure that locking (run-down) torque is still within limits 3 to 10 lbf in. (0,3 and 1,1 N.m).
 - (ii) Torque-tighten bolt to 60 lbf in. (6,8 N.m).
- E. Right-hand Gearbox Pressure Filter (Ref.Fig.713).
 - (1) Remove filter.
 - (a) Clean area of filter location.
 - (b) Fold filter paper to form a cone of similar angle to that of funnel, insert filter paper into funnel and assemble funnel to container. Mark filter paper with engine number and filter position.
 - (c) Position container under filter location to catch oil drainage.
 - (d) Release filter cover assembly quick attach/ detach nut assembly.
 - (i) Unscrew and remove bolt and spherical washer from locking trunnion.



- (ii) Use the approved drift against flat face of lug and drive nut assembly in direction to separate locking trunnions until loosened.
- (iii) Turn nut assembly until threads disengage and align with their withdrawal slots.

 Remove nut assembly.
- (e) Withdraw filter cover assembly, filter unit and sealing ring squarely from gearbox. Allow oil to drain into container.
- (f) Separate filter unit spring and cover assembly by unscrewing filter from cover. Place units in filter paper.
- (q) Carry out filter inspection (Ref.para.12).
- (h) Measure and record the quantity of oil drained from the system.
- (2) Install filter.
 - (a) Ensure that quick attach/detach nut assembly components are serviceable.

CAUTION: ENSURE THAT FILTER UNIT IS FULLY ASSEMBLED TO FILTER COVER ASSEMBLY.

- (b) Assemble filter unit to filter cover assembly.
 - (i) Position spring on cover.
 - (ii) Screw filter unit onto cover until all its thread has entered the undercut provided.
 - (iii) Check spring action.
- (c) Apply lubricant 'A' to quick attach/detach nut assembly threads and abutment flanges, and to clamping bolt, spherical nut and washer.

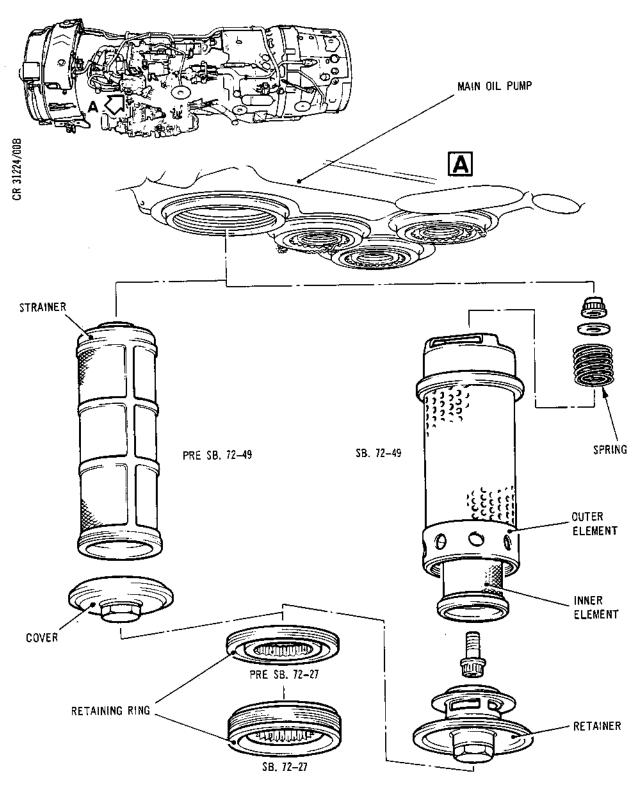
CAUTION: ENSURE THAT SEAL AND ADAPTER ARE TO SAME SERVICE BULLETIN STANDARD.

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- (d) Ascertain whether the gearbox mounted QAD adapter is to pre SB.72-7 or SB.72-7 standard and assemble a serviceable Metaflex seal of the same standard, to the adapter groove.
 - NOTE: Metaflex seals to SB.72-7 standard incorporate one and a half loose turns of stainless steel wrapper positioned around the outer circumference. This area is not laminated with asbestos and is not spot welded. Seals of this type must not be mistakenly rejected for spot weld failure in this area.
- (e) Enter filter and filter cover assembly into quick attach/detach adapter on gearbox ensuring that slots in filter cover assembly engage lugs on adapter.
- (f) Hold filter cover assembly hard against seal through base of quick attach/detach nut assembly and engage threads of nut assembly with those of threaded flange as far as possible by hand.
 - CAUTION: ENSURE THAT THREADS HAVE ENGAGED FREELY BEFORE APPLYING TIGHTENING FORCE TO NUT ASSEMBLY.
- (g) Position spherical washer on clamping bolt then insert bolt through fixed locking trunnion to engage threads of spherical nut of nut assembly trunnion by hand. Screw in clamping bolt and check that the locking (run-down) torque is within limits 3 to 10 lbf in. (0,3 and 1,1 N.m).
- (h) Tighten and lock nut assembly.
 - Ensure that nut assembly is hand-tight.
 - (ii) Torque-tighten clamping bolt to 60 lbf in. (6,8 N.m).





Main Oil Pump Delivery Pressure Filter Figure 714

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- (j) Finally tighten clamping bolt.
 - (i) Slacken bolt and ensure that locking (rundown) torque is within limits between 3 and 10 lbf in. (0,3 and 1,1 N.m).
 - (ii) Torque-tighten bolt to 60 lbf in.
 (6.8 N.m).
- F. Main Oil Pump Delivery Pressure Filter (Ref.Fig.714).
 - (1) Prepare to remove filter.
 - (a) Clean area of filter location.
 - (b) Fold filter paper to form a cone of similar angle to that of funnel, insert filter paper into funnel and assemble funnel to container. Mark filter paper with engine number and filter position.
 - (c) Position container under filter location to catch oil drainage.
 - (2) Remove filter to pre SB.72-49 standard.
 - NOTE: Procedure given applies to pre SB. and SB.72-112 standard.
 - (a) Unscrew and remove retaining ring. Withdraw filter assembly squarely from oil pump. Allow oil to drain into container.
 - (b) Unscrew and remove strainer from filter cover then place both items in filter paper.
 - (c) Carry out filter inspection (Ref.para.12).
 - (d) Measure and record the quantity of oil drained from the system.
 - (3) Remove filter to SB.72-49 standard.
 - (a) Verify the procedure detailed in paragraph (1) is completed.



- (b) Unscrew and remove retaining ring. Withdraw filter assembly squarely from oil pump. Allow oil to drain into container.
- (c) Unscrew and remove retainer from outer filter element and place retainer in filter paper.
- (d) Remove bolt, washer and nut securing spring and inner and outer filter elements together, place all items in filter paper.
- (e) Carry out filter inspection (Ref.para.12).
- (f) Measure and record quantity of oil drained from the system.
- (4) Install filter to pre SB.72-49 standard.

CAUTION: ENSURE THAT COVER/DRAIN PLUG ASSEMBLY AND STRAINER ASSEMBLY ARE TO SAME SERVICE BULLETIN STANDARD AND THAT COVER IS FULLY ASSEMBLED TO STRAINER.

NOTE: The procedure applies to pre SB. and SB.72-27 and 72-112 standards.

- (a) Screw cover onto strainer until all the thread of strainer enters undercut provided in cover.
- (b) Apply lubricant 'A' to retaining ring.
- (c) Locate filter assembly in its location and secure with retaining ring torque-tightened to between 125 and 135 lbf ft. (170 and 183 N.m).
- (d) Wire-lock retaining ring to pump casing and screwed plug to retaining ring.
- (5) Install filter to SB.72-49 standard.

CAUTION: ENSURE RETAINER/DRAIN PLUG ASSEMBLY AND FILTER ELEMENTS ARE TO THE SAME SERVICE BULLETIN STANDARD.

NOTE: Procedure given applies to pre SB. and SB.72-27 standard.

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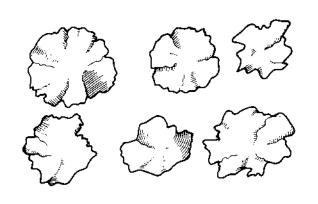
- (a) Assemble filter for installation.
 - (i) Assemble inner element to outer element.
 - (ii) Insert bolt from inside.
 - (iii) Assemble spring to bolt protrusion with small coil abutting outer element end and place washer in position over bolt to retain spring.
 - (iv) With lubricant 'A' applied, secure assembly with nut torque-tightened to bolt to between 67 and 73 lbf in. (7,6 and 8,2 N.m).
- (b) Screw retainer into outer filter element until all the threads of the retainer enter the element.
- (c) Apply lubricant 'A' to retaining ring.
- (d) Locate filter assembly in its location and secure with retaining ring torque-tightened to between 125 and 135 lbf ft. (170 and 183 N.m).
- (e) Wire-lock retaining ring to pump casing and screwed plug to retaining ring.

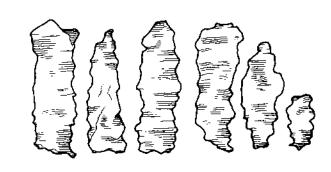
12. Magnetic Plug and Filter Inspection

- A. Process Plug Probe Deposits using Adhesive Tape.
 - (1) Remove magnetic plug from the container and remove the protective sleeve from the probe taking care not to disturb any of the adhering debris.
 - (2) Carefully wash the magnetic plug in white spirit to remove oil, again ensuring that none of the debris is knocked off the probe. Lay plug on paper towel to dry off.
 - (3) Roll the probe along a strip of transparent adhesive tape to collect all the debris particles adhering to it. Any debris which may have become transferred to the protective sleeve is to be carefully removed and added to that on the adhesive tape.

MK.610-14-28 snecma

- (4) Attach the strip of adhesive tape containing the debris to the relevant column of the appropriate engine record card, ensuring that the debris is trapped between the tape and card. Record the engine running time and date of entry.
- (5) Any debris of a suspicious nature that is found is to be subjected to a detailed microscopic examination.
 - NOTE: On the first examination of magnetic plugs from an overhauled engine a certain amount of 'build' debris may be encountered and this must be taken into account.
- (6) The following description of the more significant ferrous particles which could be found in deposits on the probes is given to assist accurate identification. Figure 715 shows typical examples of these particles.
 - (a) Roller bearing flakes are of irregular shape, of a length two or three times greater than width and with crinkles across their width.
 - (b) Ball bearing flakes are shiny, hard flat flakes, with criss-cross scratches. They are rounder and more uniform than roller bearing flakes.
 - (c) Evaluate deposits and comply with inspection/ trouble shooting procedures where necessary.
- (7) Examine the probe visually for damage, if suspect test for magnetism. A probe should be capable of lifting three unmagnetised steel 0.5 in. (13 mm) diameter balls. On completion, assemble a protective sleeve to the probe until it can be reinstalled (Ref.para.10).





BALL BEARING FLAKES

CR 31651/00A

ROLLER BEARING FLAKES

TYPICAL FERROUS BEARING PARTICLES

| A/C | NACELLE | |
|--------------------------|---------|--|
| ENGINE Nº | | |
| FILTER | | |
| RUNNING TIME HOURS MINS. | | |
| DATE | - | |
| SIGNATU | RE | |

FILTER INSPECTION RECORD ENVELOPE

Bearing Particles Identification and Typical Debris Record Figure 715

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B. Filter Inspection.

(1) Clean filter using a measured quantity of white spirit, spray clean the filter in a reverse flow direction and ensure that all deposits from the filter are collected in the filter paper and that the white spirit is collected in a container.

NOTE: If labyrinth seal abradable coatings have recently been repaired this may cause a quantity of this coating to be deposited in the filters. This does not give cause for concern provided rundown times are within specified limits, however if significant quantities of particulate matter are present in the filters (i.e. enough to cause a 5% blockage) the contents of the oil system should be dumped at the end of the test and the system should be flushed through with fresh oil before the engine is despatched.

- (2) Examine the filter for damage, if serviceable, reinstall (Ref.para.11).
- (3) Process the filter paper by spraying a measured quantity of white spirit on the filter paper to dilute the oil and accelerate drainage from deposits.
- (4) Remove the filter paper carefully from the funnel and blot dry the underside of the paper with absorbent cloth, taking care to retain all deposits.
- (5) Cut the central 2 in. dia. disc from the filter paper and place it together with its deposits in a record envelope.
- (6) Record the relevant data (Ref.Fig.715) on the record slip and insert it in the envelope for laboratory inspection and analysis.
- C. Oil Drainage Measurement.
 - (1) Measure the quantity of fluid in the container.
 - (2) Subtract from the quantity measured in (a) the quantity of white spirit added in B.(1) and (3), then record the resultant (engine oil drainage).
 - (3) Ensure that the quantity of oil drained is replenished on completion of servicing.

TESTING



SCHEDULE AND CHECKS - ENGINE TESTING

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SCHEDULE AND CHECKS - ENGINE TESTING

General

- A. The overhaul Test Schedule detailed in this section is intended to be used as a minimum test schedule for accepting engines overhauled by customer airlines.
- B. The functional check of the reheat system as detailed in this Section is not mandatory but the manufacturers strongly recommend that this testing be carried out to ensure correct functioning of the reheat system prior to installation in an aircraft.
- C. Refer to 72-00-24, Engine Testing General, for general information and 72-00-26, Procedures and Adjustments, for engine adjustments required following or during test.
- D. If it is necessary to interrupt any test, the amount of repeat testing required is at the discretion of the Quality Control Manager.
- E. Refer to the following section, Specification and Analysis (Ref. 72-00-29) for all acceptance limits.
- F. Special tools quoted in this section shall normally be identified by their Ref.No. e.g. (Tool 1234). For a complete list of tooling required for engine testing and for Manufacturers Part No., refer to Special Tools, Fixtures and Equipment, Table 1001. Tools required for testing will be identified by the makers name and Part No.

Safety Precautions and Warnings

All safety precautions and WARNINGS are to be brought to the attention of all personnel concerned with engine testing.

3. Adverse Weather Conditions

Icing conditions can exist on the ground if the ambient temperature is less than +3 deg C. Under these conditions, anticing may be selected 'ON' for general engine operations, but during performance testing anti-icing must NOT be selected 'ON'. Under these conditions a check should be made by running the engine at a speed greater than 90 per cent N2 for 5 min. If icing does not occur, the performance test may proceed, frequent.icing checks should however be made.

NOTE: Anti-icing selection may be made at all engine conditions except performance testing.

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4. Engine Checks

A. General.

All engine checks required during testing are contained in this paragraph and are to be referred to as required by the test schedule.

B. Fuel Heater Check.

Check fuel heater operation by selecting manual ON and recording fuel outlet temperature from second stage fuel pump.

C. Pneumatic Nozzle Control Setting Check.

NOTE: The PNC is a slave unit and a check on the setting should only be necessary when a replacement unit is installed or when there is inability to obtain the required calibration curve speeds. To perform a check, carry out the following procedure.

- (1) Record ambient temperature.
- (2) With E low selected (T_1 signal = ambient) set N_2 = 101.5 per cent corrected by deceleration only.
- (3) Ensure that the governed N_1 is within limits (96.15 per cent N_1 corrected \pm 0.25 per cent).
- (4) Adjust PNC to achieve an indicated NCTU angle of 79 \pm 3 deg (NT952) or 84 \pm 3 deg (NT951) at N₂ = 101.5 per cent corrected.
- D. Shut-off Valve (SOV) Latching Check.

In the OFF or NEUTRAL position of the switch the SOV receives no current thus simulating a power failure. Ensure that the SOV remains unaffected (latched) when the NEUTRAL position is selected from either a SOV open or SOV closed positions.

E. Recirculating Valve Check.

With the valve energised, a flow of 875 gal/h approximately, should be observed at 80 per cent N2 observed.

- F. Idling Speed Check.
 - (1) Ensure that the following conditions are obtained when the control lever is in the idle gate.

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- (a) Minimum N_2 = 5530 corrected.
- (b) Maximum fuel flow = 378 gal/h.
- G. Jet Pump Function Check.
 - (1) A jet pump located in the 1st stage fuel pump empties the drains tank into the recirculation line downstream of the recirculation valve when the engine is running.
 - (2) Operation of the jet pump is checked by measuring the amount of fuel remaining in the drains tank after three successive shut-downs. The remaining fuel drained from the tank should not exceed 500 cc, which is the quantity associated with one normal shut-down.

NOTE: Because the jet pump returns fuel downstream of the recirculation valve, the plant recirculating line must be open to enable the jet pump to operate, EXCEPT during performance calibrations when the plant recirculating line must be blanked. The jet pump takes approximately 30 gph fuel and will affect fuel consumption measurement if in use during performance calibrations.

- H. Drain Valves and Leakage Checks (Ref.Fig.701).
 - (1) After initial start, check for air, oil or gas leakage whilst the engine is at idling speed. Examine flanges for leaks and remedy as soon as possible. Frequent checks for leaks are to be carried out during the testing of the engine at the most convenient occasions.
 - (2) When detailed during the test schedule, check the PRESS-TO-TEST facility. This enables a quick check of gland seal serviceability to be made. An excessive fuel leakage rate from the first stage fuel pump, FCU or second stage pump glands will result in the accumulation of fuel in the PRESS-TO-TEST valve. Any drainage from the valve, when pressed open, could indicate a possible gland failure. Check for gland serviceability as follows:
 - (a) Position a container below the PRESS-TO-TEST valve.

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- (b) Press open and allow any fuel to drain into the container.
- (c) If fuel is found, disconnect each tube leading from the first stage fuel pump, FCU or second stage pump glands and secure a suitable container to each tube. If the leakage rate from any gland is in excess of the amount allowed (Ref.72-00-29, para.2.F.), refer to Trouble-shooting (Ref.72-00-35).
- (d) LP compressor front (No.1) bearing cold vent drain.

During shut down, due to loss of pressurisation there may be leakage from drain. This is allowable.

(e) Static seal drains.

Static seal drains terminate at the overboard connection alongside drains tank. Leakage is not acceptable.

(3) Turbine Drain Valve Check.

Ensure that drain valve is closed by 90 per cent N2.

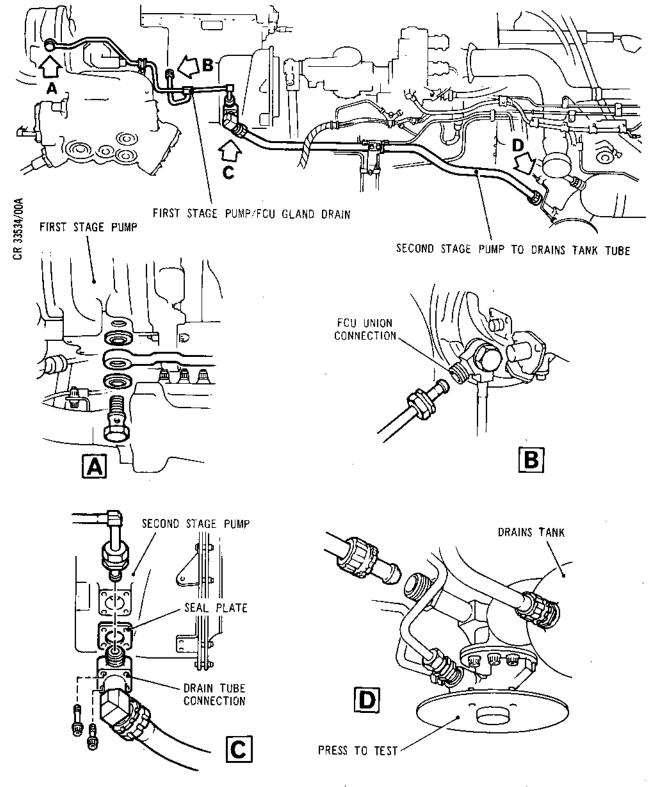
J. Single Igniter Operation Check.

WARNING: HIGH ENERGY IGNITION CAN BE LETHAL. AS A PRECAUTION, BEFORE WORKING ON THE SYSTEM, REMOVE THE INPUT FUSE AND WAIT ONE MINUTE.

- (1) Disconnect or isolate each high energy spark igniter alternatively, perform an engine start in each condition to establish the ability to light-up with one igniter out of operation.
- (2) It is permissible to complete the initial starts with both igniters and all subsequent starts with alternate igniters for the remainder of the test.
- K. Reheat System (Programmed Reheat Only) Check.
 - (1) For reheat ignition to ignite the following conditions must be satisfied.
 - (a) The throttle lever must be more than 10 per cent open.

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Gland Drain Tubes Figure 701

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- (b) N_1 must be greater than or equal to 81 per cent (Switch setting 80.5 \pm 0.5 per cent).
- (c) Reheat must be selected ON.
- (2) Reheat light-up programme check.
 - (a) Reheat light-up fuel flow (F_R) is a function of the main engine fuel flow (F_E) .
 - (b) For all conditions this programme is $F_R/F_E = 0.45$.
- (3) Reheat control programme check (Ref.Fig.702).
 - (a) After reheat light-up, reheat is controlled according to a programme defined by a given ratio between reheat and main engine fuel flow for a given ambient temperature $(T_1) \cdot F_R/F_E = f(T_1)$.
- (4) Programme procedure (Normal light-up).
 - (a) Run the engine at the required speed.
 - (b) Select the reheat switch ON.
 - (c) The following sequence will occur.
 - (i) The ignition relay sequence will take place during the following 3.5 seconds (Ignition contact light will show ON).
 - (ii) Reheat will light-up within 4 seconds.
 - (iii) Reheat detection will be indicated by reheat green ON light. (The detection will go out with high boosts).
 - (iv) Correct thrust boost will be obtained within 7 seconds.
 - (d) If any of the previous functions do not occur within stated period of time, cancel reheat and investigate.
 - NOTE: All times are taken from selection ON.
- (5) Cancellation of reheat check (two methods).
 - (a) Method one.

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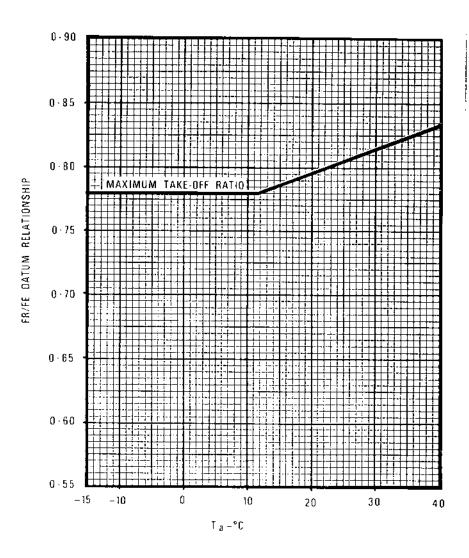
- (i) Select the reheat switch to OFF position.
- (b) Method two.
 - (i) Close the control lever, reheat will extinguish when either N₁ falls below 74 to 76 per cent (slow lever retraction).
 - (ii) Control lever becomes less than 10 per cent open (rapid lever retraction).
- (c) Select reheat OFF unless immediate reselection of reheat is required.
- (6) Reselection of reheat check.

If reheat is extinguished by cancellation it can be reselected by performing normal light-up providing the reheat switch has been selected to ON position.

- (7) Reheat function check.
 - (a) Increase engine condition to take-off dry. Record value of F_E when this parameter has stabilised.
 - (b) Select reheat ON. Ensure that the reheat sequences for normal light-up occur correctly and that the total fuel flow (TOTAL) exceeds by 1.7 times the value of $F_{\rm E}$ previously recorded.
- L. Vibration Check.
 - (1) The ALARM WARNING SYSTEM automatically monitors for vibration abnormalities throughout the test.
 - (2) Peak vibrations are to be recorded during Acceptance Test Schedule.
 - (3) Vibrations are to be recorded on the LP compressor front (No.1) bearing diaphragm (vertically). Refer to Vibration Limits (Ref.72-00-29 Specification and Analysis) for acceptable limits.
- M. Anti-icing Setting (Air Pressure) Check.
 - (1) With anti-icing selected ON at sea level static and engine at idle speed, the anti-icing air pressure should not be less than 9.5 psig at engine idle (65 per cent N₂/ 0).

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FLOWMETER CONTROLLED REHFAT DATUM PROGRAMMES

Flowmeter Controlled Reheat Datum Programme Figure 702

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- (2) The indicator light should be illuminated before 70 per cent N₂ is achieved, (65 per cent N₂ when SB.75-13 is incorporated).
- (3) Ensure that with the valve switched OFF the air pressure falls to zero.
- N. Acceleration Check.
 - (1) Select E low control at idle.
 - (2) Perform three accelerations and decelerations between 10 per cent of maximum dry thrust and take-off datum dry. Record times and stability between acceleration datum and 98 per cent of datum N2 (equivalent to 95 per cent maximum dry thrust). Time limit for complete operation must not exceed 9 seconds.
 - NOTE: During accelerations and decelerations, the control lever must be moved from stop to stop in 1 second or less.

Acceleration datum = 10 per cent of maximum dry thrust

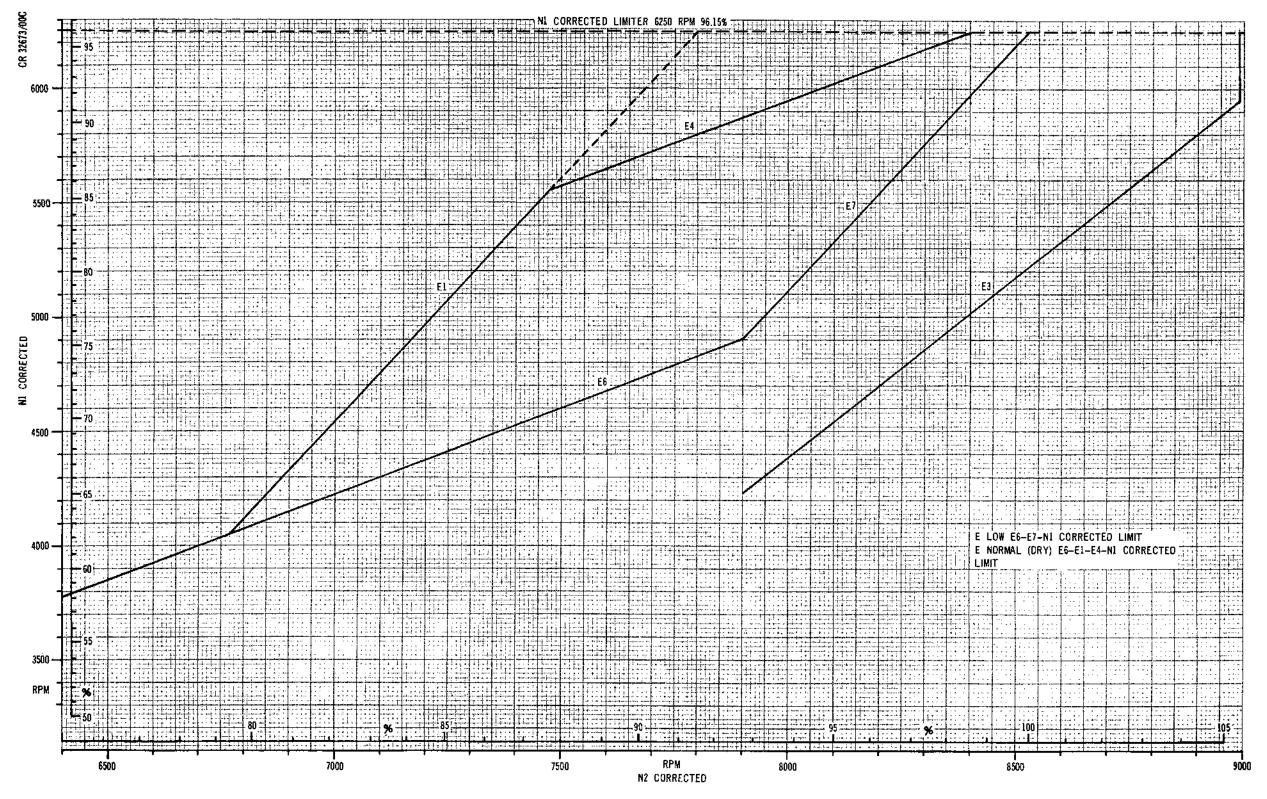
- P. Engine Control Amplifier Check.
 - NOTE: The electric amplifier used to control the engine is rig set and must not be adjusted on the test bed.
 - (1) Arming.
 - (a) The amplifier must be 'armed' by selecting the appropriate test bed switch and ensuring that the red failure light is extinguished.
 - (b) If there is a failure of any part of the control circuitry (including engine units) then the red failure light will illuminate.
 - (c) In the event of failure in 'MAIN' the lane selection switch should be moved to the 'ALTER-NATE' position, and providing that this second circuit is functioning correctly the warning light will extinguish.
 - (d) The cause of any failure must be determined and the fault rectified.



- (2) Speed selection.
 - (a) The control lever is an N_2 speed selector and is used to select the speed at which the N_2 is to be governed.
 - (b) The corresponding N₁ is determined by the selection of an engine operating line called an 'E schedule'.
- Q. 'E' Schedule Laws Check (Ref.Fig.703).
 - (1) The relationship between N_1 and N_2 is controlled by the amplifier and is illustrated on the graph. The rpm values are corrected to ISA conditions.
 - (2) The various 'E' lines are selected by a switch having two positions situated on the test bed control panel. Positions are E LOW/E NORMAL.
 - (3) For normal running, select switch to position E LOW. This will select line E6-E7-N₁ corrected limit on graph.
 - (4) For performance points select E NORMAL. This will select line E6-E1-E4-N $_1$ corrected limit.

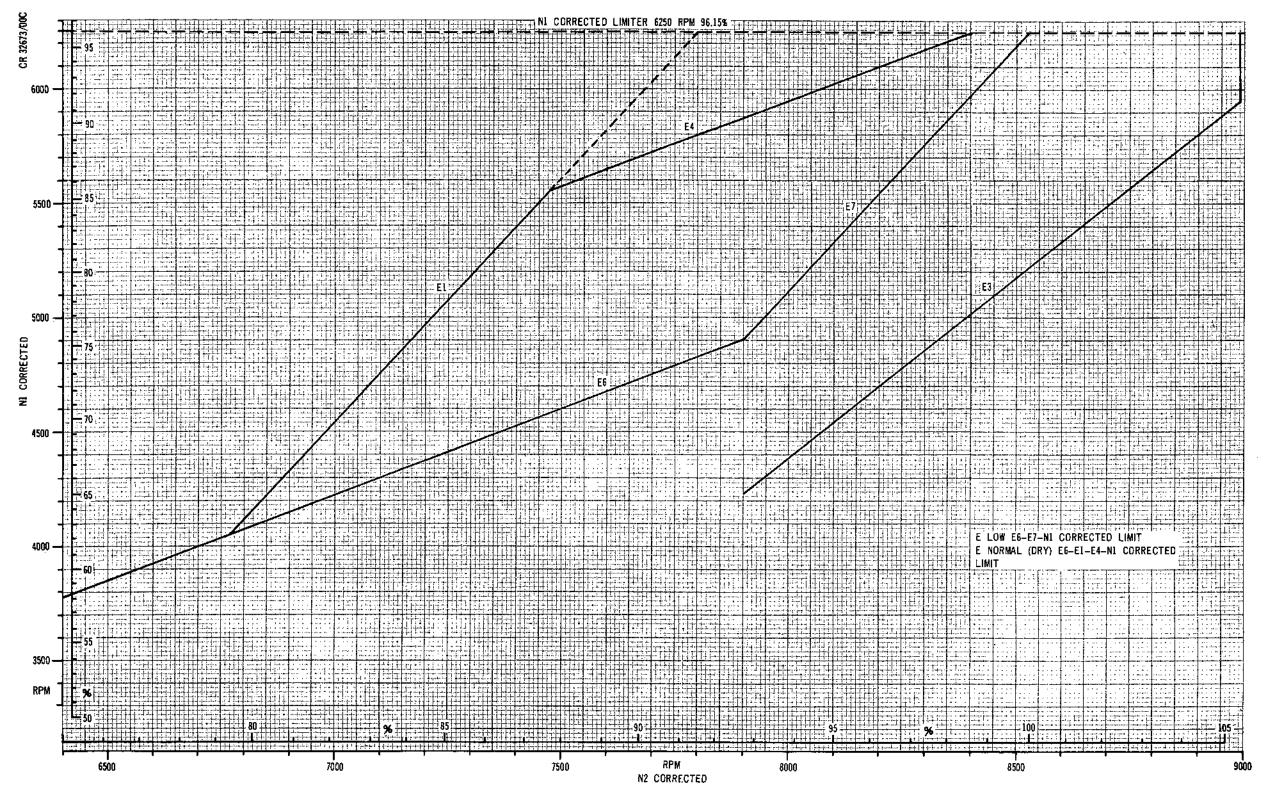
NOTE: If reheat is armed, the operating line will shift to E6-E7-N1 corrected limit regardless of E NORMAL being selected.

- (5) All schedules should be obtained at steady state conditions, within the amplifier setting tolerances of:
 - (a) E1 and E4: \pm 0.6 per cent N₁ at T₁ = 127 deg C with a linear variation to \pm 0.6 per cent N₁ at T₁ = 15 deg C \pm 1.8 per cent
 - (b) E₂, E₅ and E₇: \pm 0.6 per cent N₁ at T₁ = 50 deg C with a linear variation to + 0.6 per cent N₁ at T₁ = -50 deg C 1.8 per cent



'E' Schedule Laws Figure 703

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'E' Schedule Laws Figure 703

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- (c) Ez: <u>+</u> 0.23 per cent Nz.
- (d) E₆: <u>+</u> 1.2 per cent N₁.
- (6) Should greater accuracy be required for the performance points then the T₁ signal to the amplifier may be varied by adjusting the slave resistance box to obtain the required N₁.
- (7) The E3 schedule line shown on graph is the N2 limiter therefore speeds to the right of the line will not be obtained.
- R. HP Overspeed Governor N2 Depressed Datum Selection and Check.
 - (1) General.
 - (a) The governor consists of a set of three fly-weights mounted on a carrier and is rotated by means of a gear train from the drive shaft. Each of the weights has an arm which bears against a profiled plunger which will move when the overspeed datum is reached and spill pressure from the underside of the shut-off valve which progressively closes so as to reduce fuel flow to the engine. Since the governor has no effect during normal running conditions, it is necessary during ground testing to simulate the overspeed conditions. This is achieved by operating a datum re-set device which reduces the spring loading of the profiled plunger within the governor.
 - (b) The datum re-set device consists principally of an adjusting screw contained within a housing which may be selected to one of two positions, one position gives normal loading and the other position the reduced loading required for ground adjustment purposes.



(2) HP Overspeed Governor N2 Depressed Datum Check (Fuel System).

CAUTION:

A THROTTLE DEAD BAND WILL BE EXPERIENCED WHILST THE FCU IS ON GOVERNOR CONTROL.

IF AT ANY TIME DURING THE MOVEMENT OF THE THROTTLE LEVER, ANY UNEXPECTED ENGINE BEHAVIOUR OR SPEED VARIATION OCCURS, THE THROTTLE LEVER SHOULD BE IMMEDIATELY RETRACTED TO IDLE, AND THE CAUSE INVESTIGATED.

IF AT ANY TIME THE N_2 RPM RAPIDLY DECAYS TO BELOW AN IDLE RPM, THE ENGINE MUST BE SHUT DOWN IMMEDIATELY, AND THE CAUSE INVESTIGATED.

ON NO ACCOUNT MUST ANY PROLONGED RUNNING IN THE ROTATING STALL CONDITION, BETWEEN DEBOW AND IDLE N2 BE PERMITTED (REF. ENGINE STARTING PROCEDURES).

- (a) Check ENGINE RATING MODE switch is on TAKE-OFF.
- (b) With throttle lever at idle position, verify that engine is at steady idle rpm.
- (c) Assemble datum reset and adjuster tool (Tool 2509) to FCU HP overspeed governor and reduce datum setting (Ref. Fig. 704).
 - (i) Insert tool through support bracket on second stage pump and engage sleeve pins with datum change sleeve slots.
 - (ii) Turn sleeve in direction of arrow marked L on the support bracket. Check tool fully engaged to ensure datum depressed.
 - (iii) Leave tool in position for duration of test.

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- (d) Move throttle lever slowly and progressively until N2 stabilizes. N2 should stabilise at 89.5 plus/minus 1% and further throttle movement be ineffective.
- (e) Decelerate engine to idle rpm.

NOTE: There will be a delay in engine response to throttle lever movement.

- (f) If N2 stabilized figure as observed in paragraph (d) is outside tolerance band, adjust as follows:-
 - (i) Push inner adjuster shaft upwards against spring pressure and ensure that square end of datum governor adjuster is engaged.
 - (ii) Adjust as necessary clockwise to increase change in N2.

6 clicks = 1 turn 3 turns = 1%

(iii) Record adjustment.

If adjustment in excess of 5 turns in either direction is required, do not proceed further with this check and investigate the cause.

- (iv) Disengage inner adjuster shaft from governor adjuster and repeat check in paragraph (d).
- (g) When low datum figure is satisfactorily achieved, exercise the governor control system.
 - (i) Advance throttle lever progressively to fully open position, to achieve governed speed.
 - (ii) Decelerate engine to below 80% N2.
 - (iii) Repeat checks (i) and (ii) to complete a total of 5 governor operations.
- (h) On satisfactory completion of the above check, remove datum reset tool by turning tool outer sleeve clockwise, in direction of arrow H, as indicated on the support bracket.

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- (j) Remove tool from datum change sleeve slots and withdraw through support bracket.
- (k) Advance throttle lever progressively until N2 obtained is positively above the depressed figure previously obtained in paragraph (2).
- (l) Slowly reduce speed to idle rpm, and maintain this speed for 3 minutes.
- (3) Stop engine.

- (a) Close SOV.
- (b) Record run-down time.
- (4) Check oil tank level (Ref.72-00-26, para.8.8.).

Replenish to maximum level and record amount added.

(5) Check drain tank jet pump.

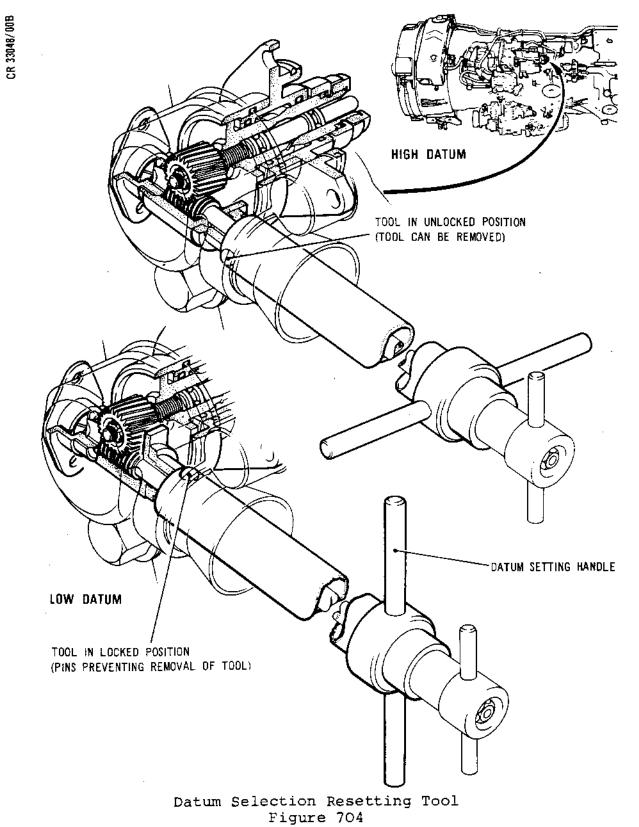
Refer to relevant paragraph (Ref. para.4.G.).

(6) For adjustment to rpm, refer to 72-00-26, Procedures and Adjustments.

NOTE: No governor high datum setting is 109.3 per cent \pm 2 per cent.

- S. Oil Consumption Check.
 - (1) Fill the oil tank to the maximum level mark on the oil tank dip-stick before test running.
 - (2) After a preliminary run with the engine still warm, replenish oil tank to the maximum level mark on the oil tank dip-stick.
 - (3) Perform test run and record time.
 - (4) Replenish oil tank with engine still warm to the maximum, level on the oil tank dip-stick and record the amount required.
 - (5) Calculate oil consumption from the running time and the amount of oil required.





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5. Engine Test Schedule Checking List

- A. During engine testing a set of instrument readings are required to ascertain the performance of the engine. The following parameters, except for those marked with an asterisk (*), required for trouble shooting only, comprise a full set of readings and are to be recorded as and when detailed during engine testing.
 - (1) Thrust (Xg).
 - (2) Thrust range.
 - (3) Second stage fuel pump outlet temperature.
 - (4) Engine differential oil pressure.
 - (5) Jet pipe temperature.
 - (6) LP rpm, (N_1) .
 - (7) HP rpm, (N2).
 - (8) Ambient temperature, Tl.
 - (9) Exhaust annulus total pressure.
 - *(10) Reheat fuel pressure.
 - *(11) Compressor delivery pressure, LP.
 - (12) Vibration, No.1 bearing.
 - (13) Fuel flow (measured), F_T.
 - (14) Fuel flow, temperature, TFT.
 - (15) HP turbine cooling air.
 - (16) LP and HP compressor thrust (No.2 and 3) bearing cold vent temperature.
 - (17) LP turbine (No.5) bearing hot vent temperature.

Aug 1/76

ATP TEMPORARY REVISION

British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

This Temporary Revision complies with BCAR's Chapter A6-2 and TSS No.0-2

Denin'thousel

For Chief Technical and Industrial Services Engineer CAA Design Approval No.DAI/8566/78

TEMPORARY REVISION NO.72-575

Insert in 72-00-27 before page 717

REASON FOR ISSUE

Deletion of some test steps

ACTION

Delete steps 5A (31) (e) and (f)

X6033



- (18) LP and HP turbine (No.4 and 5) bearing cold vent temperature.
- (19) No.12 Labyrinth vent temperature.
- (20) Cancelled.
- (21) Oil tank contents.
- (22) Cabin temperature.
- (23) Engine oil pressure.
- *(24) Gearbox oil pressure.
- (25) Datum pressure.
- (26) Oil tank pressure.
- *(27) Gallery oil pressure.
- (28) HP turbine (No.4) bearing oil drain temperature.
- (29) Engine oil inlet temperature.
- (30) HP turbine (No.4) bearing oil inlet temperature.
- (31) Venturi depression.
 - (a) PV1. (Venturi Static)
 - (b) PV2.

) Ganged

(c) PV3.

,

- (d) PV4.
- PV4 -
- (e) Cell Static.
- (f) Cabin Static.
- (32) Cell depression.
- (33) LP turbine static pressure.
- *(34) Nozzie static pressure.



- (35) HP Compressor delivery temperature.
- *(36) LP compressor front (No.1) bearing drain temperature.
- *(37) LP and HP compressor thrust (No.2 and 3) bearing drain temperature.
- *(38) LP turbine (No.5) bearing drain temperature.
- *(39) HP compressor static pressure.

6. Engine Starting Procedures

- A. False Start.
 - (1) Where a false start is required for drainage or other checks, carry out the following procedure.

WARNING: WARN ANY PERSONNEL IN THE TEST CELL OF THE INTENTION TO PERFORM A FALSE START AND ENSURE THAT THEY ARE IN A SAFE POSITION.

- (a) Position the control lever at the idle gate position.
- (b) Ensure ignition is in the OFF position.
- (c) Press the start button.
- (d) At 4 per cent N2 select fuel starter pump to ON.
- (e) Open the SOV when N2 reaches 10 per cent.
- (f) Close the SOV and select fuel starter pump to OFF after 10 seconds and continue the motoring cycle for a total of 30 seconds.

NOTE: Measure fuel drainage from the turbine drain 5 minutes after rotation has ceased. The correct operation of the valve will be indicated by the collection of a quantity of fuel.

B. Motoring Cycle.

WARNING: WARN ANY PERSONNEL IN THE TEST CELL OF THE INTENTION TO PERFORM A MOTORING CYCLE AND ENSURE THAT THEY ARE IN A SAFE POSITION.



- (1) Position the control lever to the idle position.
- (2) Ensure ignition is in the OFF position.
- (3) Ensure SOV is closed throughout the motoring cycle.
- (4) Press the start button.
- (5) Motor engine for 30 seconds.

C. Normal Start.

- (1) Before starting the engine, perform the pre-start checks as follows:
 - (a) Ensure all the supply services are ON.
 - (b) Select DEBOW.
 - (c) Select SOV to CLOSED.
 - (d) Select fuel starting pump to OFF.
 - (e) Select appropriate 'E' schedule.
 - (f) Arm air starter by selecting to ON.
 - (g) Set the control lever at the idle gate.
 - (h) Select the appropriate lane required on the flight standard control amplifier.
 - (j) Select test cell LP fuel shut-off valve to OPEN.
 - (k) Select ignition.

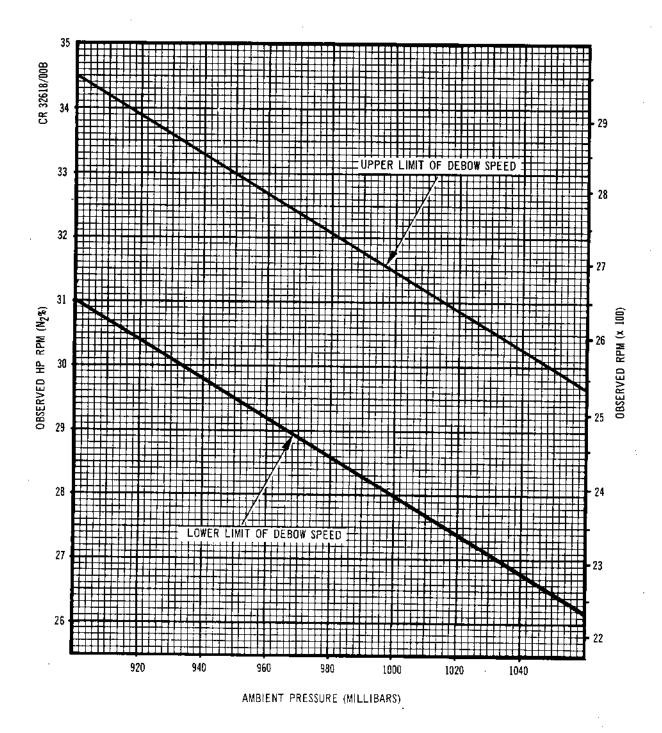
NOTE: Complete the initial start in the test schedule with both igniters in operation. Carry out subsequent starts with alternate igniters.

- (2) Press the starter button.
- (3) At 4 per cent N_2 select fuel starter pump to ON.

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Debow Speed Limitations (N_2 as a Function of Ambient Pressure) Figure 705

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(4) At 10 per cent N2 select SOV to OPEN.

NOTE: If the engine does not light within 10 seconds of opening the SOV, close the SOV and select fuel starter pump to OFF. Continue the starting cycle for a total of 30 seconds.

- (5) After one minute running, select from DEBOW to NORMAL.
- (6) At 60 per cent N₂ select the fuel starter pump to OFF.
- (7) Run at idle for a minimum of one minute or until the No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

7. Engine Stopping Procedure

- A. To stop engine, carry out following procedure.
 - (1) Set throttle lever to idling position and run at 65 per cent N_2 for three minutes to stabilise conditions.
 - (2) Close HP fuel valve.
 - (3) Check that the LP fuel pressure warning light operates by closing the test bed fuel supply valve.
 - (4) Check that the oil low pressure warning light is illuminated on run-down.
 - (5) Check that the engine runs down freely and record run-down times for N_1 and N_2 .
 - (6) When engine has stopped, switch off all supply services.
 - (7) Allow a period of 10 minutes to elapse when the engine has been running on AVTUR, or 20 minutes when running on AVTAG, before approaching the vicinity of the jet nozzle.
 - (8) If an internal fire is suspected on shut-down, make sure that the fire is extinguished before commencing the waiting period. Extinguish internal fires by carrying out a motoring cycle with the HP fuel valve closed.

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8. Prepare Engine for Acceptance Test Schedule

Test Condition

A. Carry out pre-running checks (Ref.72-00-26, para.6).

Checks and Remarks

- (1) Check control connections and instrumentation harness plugs.
- (2) Check slave control connections and instrumentation.
- (3) Check reheat transformer ratio and supply voltages (Ratio 75 ± 3; Voltage 208 + 5 V).
- (4) Check SOV solenoid (Ref.para.4.D.).
- (5) Check anti-icing valve solenoid (Ref. para.4.M.).
- (6) Check fuel recirculation solenoid (Ref. para.4.E.).
- (7) Check fuel heater valve solenoid for operation.
- (8) Check warning systems.
- (9) Perform leakage check at 30 psig minimum backing pump pressure with the HP/SOV closed and starter pump off.
 - (a) Leakage into drain tank, 10 cc/min max.

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-528
Insert in 72-00-27 before page 723

REASON FOR ISSUE:

To issue a revised procedure for engine testing that rationalises the existing procedures given in Paras 9, 10, 11, 12 and 13. The rearrangement does not omit any vital aspect of testing, applicable to BEOL, but fuel and test time savings are achieved mainly due to a reduction in the number of engine shut downs, i.e. three instead of six MRA 94.

ACTION

Delete para s 9,10,11,12 and 13 and substitute new Paras 9 and 10 (as follows). Renumber Paras 14, 15 and 16 to read 11, 12 and 13 respectively.

9. Preliminary Running

NOTE: All running is to be accomplished on E low control line, unless otherwise specified.

Test Condition

A. Start engine. (Ref. Para. 6.C.)

Checks and Remarks

- (2) Check the oil low pressure warning switch operation. The light will illuminate when start is initiated and will extinguish as the pressure increases.
- (3) Check the starter trips out at 25 per cent N2 (4,265 R.P.M.).
- (4) Record:
 - (a) Time to light up.
 - (b) Time to 25% N2 (4,265 R.P.M.)
 - (c) Time to reach idling speed.
 - (d) Maximum oil pressure.
 - (e) Maximum exhaust gas temperature.
- B. Run engine at idling R.P.M. (Ref. Para. 4.F.)

NOTE: Run engine at idle R.P.M. for a minimum of 1 min or until No. 1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

- (1) Record:
 - (a) Idling speed (N2).
 - . (b) Oil pressure.
- (2) Check installation is satisfactory.

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| 43 | Test Condition | - | Checks and Remarks |
|------------------|--|------|---|
| Vi, | | (3) | Check for air, fuel, oil or gas leaks. Rectify leaks as necessary. |
| . € 3 | Increase speed to 80 per cent N2. (6,824 R.P.M.) | | k fuel recirculation valve (Ref: . 4.E.). |
| ₽. | Increase speed slowly to 90 per cent N2. (7,677 R.P.M.) | (1) | Check operation of turbine drain valve ensure that it is closed by , 90 per cent N2. (7,677 R.P.M.). |
| φ*. | | (2) | Check operation of fuel heater (Ref: Para. 4.B.). |
| 0. | | (3) | Record oil pressure. |
| E. | Increase speed slowly to 101.5 per cent N2 corrected (8,658 R.P.M.) | (1) | N.B.: Only if necessary to check PNC setting (Ref: Para. 4.C.). |
| 14. } | Fully open throttle. (Contingency power is unnecessary but do not exceed N2 or EGT | (1) | Check vibration level limitations. (Ref: 72-00-29 Specification and Analysis). |
|) | limitation). | (2) | Check EGT temperature and N2 limitations (Ref: 72-00-29 Fig.703) |
| 9.0 | | (3) | Check agreement between the EGT circuits (Ref: 72-00-29 Specification and Analysis). |
| G. | Reduce speed to idle for 3 minutes. | (1) | Check operation of anti-icing valve (Ref. Para. 4.M.). |
| 9 | | (2) | Record N1, N2, Ta, Fe, Pa, P3 and anti-icing pressure. |
| 9 19 19. | L.P. Overspeed governor dip check. | | Run at 85 per cent N1 (4,696 R.P.M.) on E low control line. Select 'dip' Minimum N1 dip is 2 per cent and if this is not obtained at 85 per cent N1 repeat check at 90 per cent N1. |
| (E) | | (2) | (5,850 R.P.M.). Select SOV neutral, select ALT LANE and check for ALT LANE and SOV faults up to limiting N1. |
| \mathbf{J}_{0} | Slowly reduce speed to idle R.P.M. and select N2 depressed datum. | Inst | all datum tool (Ref: Para. 4.R.). |

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K. Check HP overspeed governor (N2) (mechanical).

- Accelerate onto the low datum, ensure that 89.5 + 1 per cent N2 (7,634 R.P.M.), is obtainable. Carry out checks on closed loop control.
- .
- (2) Refer any requirement to adjust to BEOL Engineering.
- L. Stop engine and check SOV latching.
- (3) Slowly reduce speed to idle R.P.M. and run at this speed for 3 mins.
- (1) Close SOV.
- (2) Check SOV latching during run-down. Refer to relevant Para. (Ref: Para 4.D.).
- (3) Record run-down time.
- M. Inspect engine master and L and RH gearbox magnetic plugs.
- N. Check fuel leakage acceptance rates (Ref: Para. 4.H.).
- (1) First stage fuel pump, FCU and stage fuel pump.
- O. Check oil leakage acceptance rates (Ref: 72-00-29 Specification and Analysis).
- (1) Static seal drains.

P. Replenish oil tank.

Replenish oil tank (Ref: 72-00-26, Procedures and Adjustments) and record amount added.

Q. Reset N2 governor to high datum.

Remove datum tool (Ref: Para. 4.R.).

- R. Complete a false start (Ref: Para. 6.A.).
- (1) Record fuel supplied to and drained from the burner gallery drain and the turbine drain.
- (2) Check flange joints for leaks.

10 . Performance Check

(3)

(3)

NOTE: Overboard bleeds must be spoilt and the drains tank drain open to atmosphere during the performance check.

NOTE: Prior to a performance point or series of performance points being taken, the engine must be heat soaked by running at 100 per cent (8,530 R.P.M.)

N2 observed for 10 mins. The minimum 3 min.soak at each condition will also apply.

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Test Condition

Checks and Remarks

- Blank fuel recirculating valve outlet.
- Start engine.

- (1) Perform starting procedure . (Ref: Para. 6.C.) (L.H. igniter).
- (2) Note the following parameters.
 - (a) Max. exhaust gas temperature.
 - (b) Check the starter trips out at 25 per cent N2 (4,265 R.P.M.) and record time:
 - (c) Time to reach settled idling speed.

C. Run engine at idling R.P.M.

NOTE: Run engine at idle for a minimum of 1 minute or until No. 1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

- Ensure anti-icing and fuel heater air bleed valves are closed.
- Select performance point conditions.

Select:

- (1) MAIN LANE.
- (2) E NOFMAL CONTROL.
- T1 = ambient.(3)
- (1) Run for 3 minutes at this speed then take full set of readings (Ref: Para. 5.).

NOTE: If engine is starting from cold, it may take longer than 3 minutes to stabilise.

- (2) Record vibration.
- (1) Run for 3 minutes at this speed then take a full set of readings (Ref: Para. 5.).
- (2) Record vibration.

Set up 5600 N1 + 10 R.P.M. (86.15%) corrected and N2 as obtained on NORMAL control (E1 -E4).

NOTE: Refer any N2 deviations from the 'E Normal' control (E1 - E4) line (Chapt. 72-00-27) Fig. 703) to BEOL Engineering.

G. Increase N1 corrected to $6250 \pm$ 10 R.P.M. (96.15%) and N2 corrected to 8,530 R.P.M. (100%).

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Test Condition

H. Maintain Nl corrected at 6,250 ± 10 R.P.M. (96.15%) and increase N2 to take-off N2 or Tj as given in Fig. 703 Chapter 72-00-29.

Checks and Remarks

- (1) Run for 3 minutes at this speed then take a full set of readings. (Ref: Para. 5.).
- (2) Record vibration.

NOTE: If, due to day conditions, take-off N2 or Tj is not obtained, retract the throttle to cause a fall of 150 R.P.M. and switch to contingency power. Advance the throttle until the required take-off or Tj value (whichever is reached first) is obtained.

After recording the required readings switch off 'contingency' before proceeding with test.

- J. Reduce power to idling and unblank the recirculating valve outlet.
- K. After 3 minutes idling stop engine. Close SOV.
- L. Measure oil consumption.
- Record amount of oil required to replenish oil tank.
- (2) Calculate oil consumption from running time and quantity of oil added.

(1) First stage fuel pump, FCU and

- M. Check fuel leakage acceptance rates (Ref: Para. 4.H.).
- second stage fuel pump.

 (1) Static seal drains.
- N. Check oil leakage acceptance rates (Ref: 72-00-29 Para. 2.E.).
- ... O. Start engine.

Perform starting procedure. (R.H. Igniter).

P. Acceleration/deceleration checks.

NOTE: During acceleration and deceleration the control lever must be moved from stop to stop in not more than I second. Time limit for the acceleration checks is 9 seconds.

NOTE: Acceleration datum = 10 per cent of maximum available dry thrust.

Q. Select E low control at idle.

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Test Condition

R. Accelerations. Carry out 3 accelerations and decelerations from the acceleration datum to the take-off datum. Time limit of 9 seconds maximum for each acceleration (Ref: Para.

Checks and Remarks

- Carry out 3 accelerations and decelerations between acceleration datum and take-off datum dry.
- (2) Record times and stability between acceleration datum and 98 per cent of datum N2 (equivalent to 95 per cent maximum dry thrust).
- S. Reduce engine speed to idle R.P.M. and run at this speed for 3 mins.

Check for air, fuel, oil or gas leaks. Rectify leaks as necessary.

- T. Perform the inhibiting procedure.
 Run engine at 75 per cent N2
 (6,397 R.P.M.).
 - U. Switch to inhibiting fluid.
- (1) When 6 to 7 gallons of inhibiting oil has been used, inhibiting has been accomplished.

NOTE: Satisfactory inhibiting can normally be confirmed by observing 'whitish' exhaust from the jet nozzle immediately after closing the engine SOV.

V. Stop engine.

7

4.N.).

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Close SOV.

W. Check drain tank jet pump.

Quantity drained should not exceed 500 c.c. if pump is working correctly.





Test Condition

Checks and Remarks

(b) Leakage into engine, nil.

- B. Pre-running functional checks.
- (1) Record engine fuel inlet pressure.
- (2) Check MAIN LANE and ALTERNATE LANE arming.
- (3) Check reheat igniter for operation.
- (4) Perform reheat system static check. Place control lever at maximum and switch in false N₁ signal.
- (5) Replenish oil tank as required (Ref.72-00-26, page 702).
- C. Carry out a motoring cycle (Ref.para.6.B.).
- (1) Adhere to starter
 limitations (72-00-29,
 Specifications and
 Analysis).
- (2) Record max N2.
- (3) Record max oil pressure.
- (4) Record oil contents gauge reading and check result against oil tank dip-stick reading.

9. Preliminary Running

NOTE: All running is to be accomplished on E low control line unless otherwise specified.

A. Start engine. (Ref.para.6.C.).

(1) Perform starting procedure.



Checks and Remarks

- (2) Check the oil low pressure warning switch operation. The light will illuminate when start is initiated and will extinguish as the pressure increases.
- (3) Check the starter trips out at 25 per cent N₂ and record time.
- (4) Record:
 - (a) Time to light-up.
 - (b) Time to reach idling speed.
 - (c) Maximum oil pressure.
 - (d) Maximum exhaust gas temperature.
- B. Run engine at idling rpm (Ref.para.4.F.).

NOTE: Run engine at idle rpm for a minimum of I min or until No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

- (1) Record:
 - (a) Idling speed (N2).
 - (b) Oil pressure.
- (2) Check installation is satisfactory.
- (3) Check for air, fuel, oil or gas leaks. Rectify leaks as necessary.

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Checks and Remarks

- C. Increase speed to 80 per cent Nz.
- Check fuel recirculation valve (Ref.para.4.E.).
- D. Increase speed slowly to 90 per cent N2.
- (1) Check operation of turbine drain valve ensure that it is closed by 90 per cent N2.
- (2) Check operation of fuel heater (Ref.para.4.B.).
- (3) Record oil pressure.
- E. Increase speed slowly to 85 per cent N₁, select reheat to 'ON'.
- (1) Check that reheat functions correctly (Ref.para.4.K.).
- (2) Select reheat OFF.
- F. Increase speed slowly to 101.5 per cent N2 corrected.
- (1) If necessary check PNC setting (Ref.para.4.C.).
- G. Select take-off T_J datum and increase to max. dry condition.
- (1) Check vibration level limitations (Ref. 72-00-29 Specification and Analysis).
- (2) Check temperature limitation (Ref.72-00-29 Specification and Analysis).
- (3) Check agreement between the EGT circuits (Ref. 72-00-29 Specification and Analysis).
- H. Reduce speed to idle for 3 min.
- (1) Check operation of antiicing valve (Ref.para. 4.M.).
- (2) Record N₁, N₂, Ta, Fe, Pa, P₃ and anti-icing pressure.

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Test Condition

Checks and Remarks

- (3) Re-route the engine No.1 bearing vibration transducer cable from the test bed Vibrometer system to the DEVS signal conditioning equipment. If it is necessary to shut the engine down to reconnect the cable then restart the engine using normal procedures.
- (4) Initiate the DEVS data acquisition process (refer to Para.1.H, 72-00-25 Testing) and carry out a slow (1 minute) acceleration from idle to max. dry (Take-off) followed by a slow deceleration (1 minute) to idle.
- (1) Close SOV valve and record time to cease rotation.
- (2) Carry out the DEVS analysis procedure to produce plots of Broadband, HP ordered and LP ordered vibration amplitudes plus Fuel Pressure Oscillation amplitude against No. A copy of the acquired data file is to be transferred to floppy disc for transmission to Olympus 593 Project Office, Rolls-Royce plc, P.O. Box 3, Filton, Bristol, BS12 7QE.

Stop engine.

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Test Condition

Checks and Remarks

(3) For vibration and pressure oscillation limits above which further investigation and possible corrective action may be required see Vibration Limits 72-00-29 Testing.

NOTES: Vibration levels for contractual purposes are to be measured using the existing Vibrometer equipment.

Subsequent testing may continue with the DEVS system active in which case engine vibration must be monitored using DEVS. If preferred the vibration signal cables may be reconnected to the Vibrometer equipment.

K. Inspect filters.

Remove, inspect, clean and reinstall pressure and scavenge oil filters. Inspect engine master and right-hand gearbox magnetic plugs (Ref.72-00-26 Procedures and Adjustments).

- L. Check fuel leakage acceptance rates (Ref. para.4.H.).
- M. Check oil leakage acceptance rates (Ref. 72-00-29 Specification and Analysis).
- N. Replenish oil tank.
- P. Complete a false start (Ref.para.6.A.).

- (1) First stage fuel pump, FCU and second stage fuel pump.
- (1) Static seal drains.

Replenish oil tank (Ref.72-00-26, Procedures and Adjustments) and record amount added.

- (1) Record fuel supplied to and drained from the burner gallery drain and the turbine drain.
- (2) Check flange joints for leaks.

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Checks and Remarks

10. LP and HP Overspeed Governor Checks

A. Start engine (Single igniter).

- (1) Perform starting procedure (Ref.para.6.C.).
- (2) Note the following parameters.
 - (a) Max. exhaust gas temperature.
 - (b) Check the starter trips out at 25 per cent N₂ and record the time.
 - (c) Time to reach settled idling speed.
- B. Run engine at idling rpm.
 - NOTE: Run engine at idle rpm for a minimum of 1 min or until No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.
- C. LP overspeed governor dip check.
- (1) Run at 85 per cent N2 on E low control line. Select 'dip'. Minimum N2 dip is 2 per cent, if this does not occur repeat check at 90 per cent N2.
- (2) Select SOV neutral, select ALT LANE and check for ALT LANE and SOV faults up to limiting N1.
- (3) Slowly reduce speed to idle rpm and run at this speed for 3 min.

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OVERHAUL

Test Condition

Checks and Remarks

- D. Stop engine and check SOV latching.
- (1) Close SOV.
- (2) Check SOV latching during run-down. Refer to relevant para. (Ref. para.4.D.).
- (3) Record run-down time.
- E. Start engine (single igniter).
- (1) Perform starting procedure (Ref.para.6.C.).
- (2) Note the following parameters.
 - (a) Max. exhaust gas temperature.
 - (b) Check the starter trips out at 25 per cent N2 and record time.
 - (c) Time to reach settled idling speed.
- F. HP Overspeed Governor N2 Depressed Datum Check (Fuel System).

CAUTION: A THROTTLE DEAD BAND WILL BE EXPERIENCED WHILST THE FCU IS ON GOVERNOR CONTROL.

IF AT ANY TIME DURING THE MOVEMENT OF THE THROTTLE LEVER, ANY UNEXPECTED ENGINE BEHAVIOUR OR SPEED VARIATION OCCURS, THE THROTTLE LEVER SHOULD BE IMMEDIATELY RETRACTED TO IDLE, AND THE CAUSE INVESTIGATED.

IF AT ANY TIME THE N2 RPM RAPIDLY DECAYS TO BELOW AN IDLE RPM, THE ENGINE MUST BE SHUT DOWN IMMEDIATELY, AND THE CAUSE INVESTIGATED.

ON NO ACCOUNT MUST ANY PROLONGED RUNNING IN THE ROTATING STALL CONDITION, BETWEEN DEBOW AND IDLE N2 BE PERMITTED (REF. ENGINE STARTING PROCEDURES).

(1) Check ENGINE RATING MODE switch is on TAKE+OFF.

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- (2) With throttle lever at idle position, verify that engine is at steady idle rpm.
- (3) Assemble datum reset and adjuster tool (Tool 2509) to FCU HP overspeed governor and reduce datum setting (Ref. Fig. 704).
 - (a) Insert tool through support bracket on second stage pump and engage sleeve pins with datum change sleeve slots.
 - (b) Turn sleeve in direction of arrow marked L on the support bracket. Check tool fully engaged to ensure datum depressed.
 - (c) Leave tool in position for duration of test.
- (4) Move throttle lever slowly and progressively until N2 stabilizes. N2 should stabilise at 89.5 plus/ minus 1% and further throttle movement be ineffective.
- (5) Decelerate engine to idle rpm.

NOTE: There will be a delay in engine response to throttle lever movement.

- (6) If N2 stabilized figure as observed in paragraph (4) is outside tolerance band, adjust as follows:-
 - (a) Push inner adjuster shaft upwards against spring pressure and ensure that square end of datum governor adjuster is engaged.
 - (b) Adjust as necessary clockwise to increase change in N2.

6 clicks = 1 turn 3 turns = 1%

(c) Record adjustment.

If adjustment in excess of 5 turns in either direction is required, do not proceed further with this check and investigate the cause.

(d) Disengage inner adjuster shaft from governor adjuster and repeat check in paragraph (4).

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- (7) When low datum figure is satisfactorily achieved, exercise the governor control system.
 - (a) Advance throttle lever progressively to fully open position, to achieve governed speed.
 - (b) Decelerate engine to below 80% N2.
 - (c) Repeat checks (a) and (b) to complete a total of 5 governor operations.
- (8) On satisfactory completion of the above check, remove datum reset tool by turning tool outer sleeve clockwise, in direction of arrow H, as indicated on the support bracket.
- (9) Remove tool from datum change sleeve slots and withdraw through support bracket.
- (10) Advance throttle lever progressively until N2 obtained is positively above the depressed figure previously obtained in paragraph (4).
- (11) Slowly reduce speed to idle rpm, and maintain this speed for 3 minutes.
- G. Stop engine.

- (1) Close SOV.
- (2) Record run-down time.
- H. Check oil tank level (Ref.72-00-26, para.8.B.).

Replenish to maximum level and record amount added.

J. Check drain tank jet pump.

Refer to relevant paragraph (Ref. para.4.G.).

11. Performance Check

NOTE: Overboard bleeds must be spoilt and the drains tank drain open to atmosphere during the performance check.

NOTE: Prior to a performance point or series of performance points being taken, the engine must be heat soaked by running at 100 per cent (8530 rpm) N2 observed for 10 min. The minimum 3 min. soak at each condition will also apply.

A. Blank fuel recirculating valve outlet.

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B. Start engine (Single igniter). Checks and Remarks

- (1) Perform starting procedure (Ref.para.6.C.).
- (2) Note the following parameters.
 - (a) Max. exhaust gas temperature.
 - (b) Check the starter trips out at 25 per cent N₂ and record time.
 - (c) Time to reach settled idling speed.
- C. Run engine at idling rpm.

NOTE: Run engine at idle for a minimum of 1 min or until No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

- D. Ensure anti-icing and fuel heater air bleed valves are closed.
- E. Select performance point conditions.

Select:

- (1) MAIN LANE.
- (2) E NORMAL CONTROL.
- (3) T₁ = ambient.
- Set up 5600 $N_1 \pm 10$ rpm (1) Run for 3 min at this corrected and N_2 as speed then take full obtained on NORMAL control set of readings (Ref. (E1 E4).

NOTE: In some cases the actual value of N₂ corrected may be greater than denoted by the NORMAL control line because the maximum nozzle area has been achieved.

G. Increase N₁ corrected to 6250 ± 10 rpm and N₂ corrected to 8530 rpm. NOTE: If engine is starting from cold, it may take longer than 3 min. to stabilize.

- (2) Record peak vibration.
- (1) Run for 3 min at this speed then take a full set of readings (Ref. para.5).

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Checks and Remarks

- (2) Record peak vibrations.
- H. Maintain N_1 corrected at 6250 \pm 10 rpm and increase N_2 to take-off N_2 or T_j .
- (1) Run for 3 min at this speed then take a full set of readings. (Ref. para.5).
- (2) Record peak vibrations.

NOTE: If N₂ is not obtained, decrease speed by 150 rpm. Select 'Contingency On' (speed will increase by approximately 130 rpm). Increase N₂ to take-off N₂ or T_j. Select 'Contingency Off' after taking readings. If engine is still running on EGT Limiter, the engine is not acceptable if the N₂ speed is more than 80 rpm below the nominal take-off level when running within the plus or minus 3 deg. tolerance of take-off EGT.

J. Maintain speed at or above 100 per cent N₂. A minimum running time of 15 minutes inclusive of previous test performance time is required to facilitate the oil consumption check.

K. Decrease speed to idle rpm. Run for 3 min at this speed.

L. Stop engine.

- Close SOV valve and record time to cease rotation.
- M. Measure oil consumption.
- Record amount of oil required to replenish oil tank.
- (2) Calculate oil consumption from running time and quantity of oil added.
- (1) First stage fuel pump, FCU and second stage fuel pump.
- (1) Static seal drains.
- N. Check fuel leakage acceptance rates (Ref. para.4.H.).
- P. Check oil leakage acceptance rates (Ref. 72-00-29 para.2.E.).

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Test Condition

Checks and Remarks

Q. Inspect magnetic plugs of right-hand gearbox and engine master. Refer to 72-00-26, Procedures and Adjustments.

R. Unblank the fuel recirculating valve outlet and return the drains tank to normal condition.

12. Proof Run and Handling Checks

NOTE: On completion of test schedule, a proof run is performed to check for leaks. The condition of the engine is to be equal to and as installed in the aircraft condition. Slave instrumentation is to be removed and flight blanks fitted.

CAUTION: ENSURE THE SLAVE BLANK, PIGTAIL AND TRANSDUCER ARE REMOVED FROM THE DDV AND A FLIGHT BLANK INSTALLED.

- A. Flight blanking and wirelocking.
- (1) Disconnect slave instrumentation not required for proof test.
- (2) Install clean, dry flight blanks as required and wire-lock where necessary.
- (3) Wire-lock all adjusters.

B. Start engine.

- (1) Perform starting procedure (Ref.para.6.C).
- (2) Note the following parameters.
 - (a) Max. exhaust gas temperature.
 - (b) Check the starter trips out at 25 per cent N₂ and record time.
 - (c) Time to reach settled idling speed.

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Checks and Remarks

C. Run engine at idling rpm.

NOTE: Run engine at idle rpm for a minimum of 1 min or until No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

D. Acceleration/deceleration checks.

NOTE: During acceleration and deceleration the control lever must be moved from stop to stop in not more than 1 second. Time limit for the acceleration checks is 9 seconds.

NOTE: Acceleration datum = 10 per cent of max. dry thrust.

(1)

- E. Select E low control at idle.
- F. Accelerations.
 Carry out 3 accelerations
 and decelerations from the
 acceleration datum to the
 take-off datum. Time
 limit of 9 seconds maximum
 for each acceleration
 (Ref.para.4.N.).
- tions and decelerations
 between acceleration
 datum and take-off
 datum dry.

Carry out 3 accelera-

- (2) Record times and stability between acceleration datum and 98 per cent of datum N₂ (equivalent to 95 per cent max. dry thrust).
- G. Run engine at 100 per cent N₂ (8530 rpm).
- H. Reduce engine speed to idle rpm and run at this speed for 3 min.
- J. Stop engine.

Maintain condition for 5 min.

Check for air, fuel, oil or gas leaks. Rectify leaks as necessary.

- (1) Close SOV.
- (2) Record run-down time.

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13. Engine and Reheat Fuel System Inhibiting

- Preparation for inhibiting.
- (1)Ensure that the inhibiting tank contains 7 gallons (minimum) of approved inhibiting fuel (Ref. 72-00-24).
- (2) Disconnect the electrical feed to the reheat igniter circuit.
- (3) Arm the reheat control amplifier by feeding in a slave N₁ speed signal of greater than 90 per cent.
- (4) Disconnect the normal speed signal from engine to reheat amplifier.
- Perform starting pro-(1)
- cedure (Ref.para.6.C).
- Perform the inhibiting procedure. Run engine at 75 per cent N2.

Run engine at idling rpm.

Start engine.

в.

. C.

D.

- (1) Switch amplifier selector to the OFF position.
- (2) Arm the reheat circuit by placing the control lever at the 'MID' position.
- Switch to inhibiting fluid.
- (1)When the inhibiting fluid has reached the engine (usually indicated by a slight drop in speed) at a fixed control lever setting, select reheat ON for approx. 5 seconds.

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Checks and Remarks

- (2) Ensure that the flow of inhibiting oil increases during this period.
- (3) When 6 to 7 gallons of inhibiting oil has been used, inhibiting has been accomplished.

NOTE: Satifactory inhibiting can normally be confirmed by observing 'whitish' exhaust from the jet nozzle immediately after closing the engine SOV.

F. Stop engine.

Close SOV.

G. Revert reheat system feeds to normal.

14. Prepare Engine for Despatch from Test Cell

- A. Inspect pressure and scavenge (1) Refer to 72-00-26, oil filters. para.11.
- B. Inspect engine master and right-hand gearbox magnetic plugs.
- (1) Refer to 72-00-26, para.10.

C. Drain oil system.

- (1) Refer to 72-00-26, para.9.
- (2) Install clean, dry blanks.
- D. Inspect for visible damage to the compressor and turbine blading.
- Check for freedom of compressor rotation.
- E. Ensure all apertures are correctly blanked.
- F. Inspect the engine externally for oil staining or burns.

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Checks and Remarks

- G. Ensure engine has inspection clearance before removing from test cell.
- H. Ensure primary nozzle has inspection clearance before removing from test cell.

15. Remove Engine from Test Cell

- A. Disconnect engine test services.
- B. Remove engine from test cell.
- (1) Refer to 72-00-25, para.7.
- (1) Refer to pedestal mounted engine (Ref.72-00-25, para.8).
- (2) Refer to overhead
 rail mounted engine
 (Ref.72-00-25, para.9).
- C. Remove slave accessories.
- (1) Refer to 72-00-25, para.10.
- D. Install air intake and exhaust covers.
- (1) Refer to 72-00-25, para.ll.

16. Test Requirements Following Module Changes

A. General.

- (1) The testing of an engine in a test cell following a module change is not covered by this manual.
- (2) Reference should be made to the appropriate Maintenance Manual for testing an engine in the aircraft following a module change.
- (3) The following table is for reference only of module changes and the test requirement.

TESTING

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| CODE | MODULE | TEST REQUIREMENT IN THE TEST CELL |
|------|--------------------------|--------------------------------------|
| M.Ol | Air Intake Casing (AIC) | None |
| M.O2 | LP Compressor (LPC) | None |
| M.O3 | Intermediate Casing (IC) | None |
| M.04 | LH Gearbox (LHG) | None |
| M.05 | RH Gearbox (RHG) | None |
| M.06 | Base Module (BM) | None |
| M.07 | Combustion Chamber (CC) | None |
| M.08 | HP Turbine Nozzle (HPN) | None |
| м.09 | HP Turbine Rotor (HPR) | None |
| M.10 | LP Turbine Nozzle (LPN) | None |
| M.11 | LP Turbine Rotor (LPR) | None |
| M.12 | Exhaust Diffuser (ED) | None |
| M.13 | Primary Nozzle (PN) | None |
| M.14 | Jet Pipe (JP) | None |

Test Requirement Following a Module Change Table 701



SCHEDULE FOR PROOF TEST PROCEDURE AFTER MINOR RECTIFICATION - ENGINE TESTING

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SCHEDULE FOR PROOF TEST PROCEDURE AFTER MINOR RECTIFICATION - ENGINE TESTING

1. General

- A. This schedule details the proof test procedure that Rolls-Royce Limited, consider to be the minimum necessary to prove the satisfactory functioning and performance of the engine. This procedure details the minimum requirements but each arising must be treated on its merits. The amount or extent of strip or rectification will dictate the severity of the test.
- B. In any circumstances when the strip involves the removal of major assemblies which may influence the performance or acceptability of the engine, the engine shall be tested to the full acceptance test schedule (Ref. 72-00-27, Engine Test Schedule and Checks, para.11).
- C. When minor parts have been changed, the test may be reduced, at the discretion of the Quality Manager or Approving Authority, but the minimum requirements of this schedule will be satisfactorily completed together with any further testing scheduled by the Quality Manager or Approving Authority.
- D. It will not normally be necessary to connect up all the test bed instrumentation, only that necessary to establish engine performance, and any special requirements of test.
- E. It will not always be necessary to plot a performance curve, i.e. if the engine has not been stripped and the remedial action taken will not influence performance.
- F. The performance figures required from the engine are given in the following section (Ref. 72-00-29, Specification and Analysis).

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2. Prepare for Engine Running

Test Conditions

A. Carry out pre-running checks

Checks and Remarks

- (1) Check control connections and instrumentation harness plugs.
- (2) Check slave control connections and instrumentation.
- (3) Check SOV solenoid.
- (4) Check anti-icing valve solenoid.
- (5) Check fuel recirculating solenoid.
- (6) Check fuel heater valve solenoid.
- (7) Check warning systems.
- (8) Carry out leakage checks at 30 psig backing pump pressure with HP SOV closed and starter pump off.
- (9) Check for leakage into drains tank, maximum allowable 10 cc/min.
- (10) Check for leakage into engine, none allowed.
- (11) Fill oil tank (Ref.72-00-26, Procedures and Adjustments, para.4).



3. Perform Motoring Cycle

Test Conditions

Checks and Remarks

- A. Perform pre-motoring cycle check
- (1) Select:
 - (a) Control lever IDLE
 - (b) Ignition OFF
 - (c) SOV CLOSED
 - (d) Air starter arming ON
 - (e) Starter pump OFF
- B. Start and motor for 30 seconds.
- (1) Press start button.
- (2) Record:
 - (a) Oil pressure.
 - (b) Maximum N₂.

- C. Stop motoring.
- Select air starter arming switch OFF.
- (2) Record oil contents gauge reading and check result against oil tank dip-stick reading.

4. Proof Test

- A. Perform pre-start check.
- (1) Supply services ON.
- (2) Select DEBOW.
- (3) Select SOV to CLOSED.
- (4) Select starter pump to OFF.
- (5) Select E LOW.
- (6) Arm air starter by selecting to ON.
- (7) Set control lever at the idle gate.

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Checks and Remarks

- (8) Select MAIN LANE.
- (9) Select test cell LP fuel shut-off valve ON.
- (10) Select ignition BOTH.

B. Start Engine.

- (1) Record the following:
 - (a) The oil low pressure warning switch operation. The light will illuminate when start is initiated and will extinguish as the pressure increases.
 - (b) Time to light up.
 - (c) Time the starter trips out at 25 per cent N_2 .
 - (d) Max. exhaust gas temperature.
 - (e) Time to reach idling speed.
- (2) Press the start button.

- C. 4 per cent N_2 .
- D. 10 per cent N_2 .
- E. Run engine for one minute then select NORMAL.
- F. 60 per cent N_2 .

- (1) Select starter pump ON.
- (1) Select SOV to OPEN.
- (1) Engine speed will automatically accelerate to 67 per cent N₂/ θ and return to idle.
- (1) Select starter pump to OFF.
- G. Run engine at idling rpm (Ref.72-00-27, para.4.F.).
 - NOTE: Run engine at idling rpm for a minimum of 1 min or until No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s whichever is the longer.

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Checks and Remarks

- (1) Record:
 - (a) Idling speed (N2).
 - (b) Oil pressure.
- (2) Check installation is satisfactory.
- (3) Check for air, fuel, oil or gas leaks. Rectify leaks as necessary.
- C. Increase engine speed slowly to 90 per cent N₂.

Check oil pressure.

- D. Run engine at N₁ corrected to 6250 ± 10 rpm and N₂ corrected to 8600 conditions for 10 minutes.
- E. Select reheat ON.
- (1) During this period select FR/FE Take-off, Normal, select reheat ON, verify reheat sequence, select reheat OFF after 1 minute.
- (1) Select reheat ON and verify reheat sequence as follows:
 - (a) The ignition relay sequence will take place during the next 3.5 seconds. (Ignition contact light will show ON).
 - (b) Reheat will light up within 4 seconds.
 - (c) Reheat detection will be indicated by reheat green ON light.
 - (d) Correct thrust will be obtained within 7 seconds.

Checks and Remarks

- (2) If any of the previous functions do not occur immediately, cancel reheat and investigate.
 - NOTE: All times are taken from selection of reheat.

- F. Select reheat OFF.
- (1) Select reheat OFF after 1 minute.
- (2) Continue to run engine at N_1 corrected to 6250 \pm 10 rpm and N_2 corrected to 8600 conditions until the total time of 10 minutes has elapsed.

G. Stop engine.

- (1) Run engine at idling rpm for 2 minutes.
- (2) Close SOV.
- (3) Record run down time.
- (4) Disconnect the slave test bed instrumentation.
- (5) Install clean, dry flight blanks and wire-lock as necessary.



Checks and Remarks

- (6) Wire-lock all adjustments.
- (7) Disconnect electrical feed to reheat igniter circuit.

5. Fuel System Inhibiting

- A. Preparation for inhibiting.
- B. Perform pre-start check.
- (1) Ensure contents of the inhibiting tank contains sufficient oil to give 7 gallons of inhibitor type D.Eng.R.D.2490 to the engine.
- (1) Supply services ON.
- (2) Select DEBOW.
- (3) Select SOV to CLOSED.
- (4) Select starter pump to OFF.
- (5) Select E LOW.
- (6) Arm air starter by selecting to ON.
- (7) Select MAIN LANE.
- (8) Select test cell LP fuel shut-off valve ON.
- (9) Select ignition BOTH.
- (10) Arm the reheat control amplifier by feeding in a slave N₁ speed signal of greater than 90 per cent N₁.
- (11) Disconnect the normal speed signal from the engine to the reheat amplifier.
- (1) Record the following:

C. Start engine.

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Checks and Remarks

- (a) The oil low pressure warning switch operation. The light will illuminate when start is initiated and will extinguish as the pressure increases.
- (b) Time to light up.
- (c) Time the starter pump trips out at 25 per cent N_2 .
- (d) Max. exhaust gas temperature.
- (e) Time to reach idling speed.
- (2) Press the start button.

- D. 4 per cent N_2 .
- E. 10 per cent N2.
- F. Run engine for one minute then select NORMAL.
- G. 60 per cent N_2 .

- (1) Select starter pump ON.
- (1) Select SOV to OPEN.
- (1) Engine speed will automatically accelerate to 67 per cent $N_2/\sqrt{\theta}$ and then return to idle.
- (1) Select starter pump OFF.
- H. Run engine at idling rpm.
 - NOTE: Run engine at idle rpm for a minimum of 1 min or until No.1 bearing vibration displayed on the filtered alarm indicator falls below 2 in./s, whichever is the longer.
 - Check for air, fuel, oil or gas leaks. Rectify as necessary.
- J. Increase speed to 75 per cent N₂ and maintain during inhibiting.
- (1) Switch amplifier selector to 'MID' position.
- (2) Arm the reheat circuit by placing the control lever at the 'MID' position.

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ATP TEMPORARY REVISION

British airways

CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

This Temporary Revision complies with BCAR's Chapter A6-2 and TSS No.0-2

Denis Loredall

For Chief Technical and Industrial Services Engineer CAA Design Approval No.DAI/8566/78

TEMPORARY REVISION NO.72-576

Insert in 72-00-28 before page 709

REASON FOR ISSUE

BEOL NOTE added

ACTION

Read the following NOTE after paragraph K heading:-

BEOL NOTE:

To ensure the reheat controller is inhibited, the engine inhibiting run is to be carried out for at least 70 seconds, it is estimated that the amount of inhibiting oil used will not greatly exceed 6-7 gallons as quoted in para. K (2).

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Checks and Remarks

- K. Switch to inhibiting fluid.
- (1) When the inhibiting fluid has reached the engine (usually indicated by a slight drop in speed at a fixed control setting), select reheat on for approximately 5 seconds and ensure that flow increases.
- (2) After 6 to 7 gallons of inhibiting oil has been used, inhibiting has been accomplished.

NOTE: Satisfactory inhibiting can normally be confirmed by observing 'whitish' exhaust from the final jet pipe immediately after closing engine SOV.

(1)

L. Stop engine.

- (1) Close SOV.
- (2) Revert reheat system feeds to normal.

Prepare Engine for Despatch from Test Cell

- A. Drain left and righthand gearboxes.
- (1) Refer to 72-00-26, para.9.
- B. Inspect engine master and right-hand gearbox magnetic plugs.
- (1) Refer to 72-00-26, para.10 for removal/assembly procedure and para.12 for inspection procedure.
- C. Inspect all pressure and scavenge oil filters.
- Refer to 72-00-26, para.ll for removal/assembly procedure and para.l2 for inspection procedure.
- D. Inspect for visible damage to the compressor and turbine blading.
- Check for freedom of compressor rotation.
- E. Ensure all apertures are correctly blanked.
- F. Inspect the engine externally for oil staining or burns.



Checks and Remarks

- G. Ensure engine has inspection clearance before removing from test cell.
- H. Ensure primary nozzle has inspection clearance before removing from test cell.

CAUTION: FAILURE TO INSTALL THE ELECTRICAL HARNESS CORRECTLY WILL LEAD TO DAMAGE WHICH CAN RESULT IN SERIOUS AIRWORTHINESS PROBLEMS.

J. Check the main electrical harness to ensure that the cable runs have adequate clearance and are clipped correctly as specified in the relevant procedure for the affected component.

7. Remove Engine from Test Cell

- A. Disconnect engine test services.
- (1) Refer to 72-00-25, para.7.
- B. Remove engine from test cell.
- (1) Refer to 72-00-25, para.8 for pedestal mounted engine or para.9 for overhead rail mounted engine.

C. Remove slave accessories.

- (1) Refer to 72-00-25, para.10.
- D. Install air intake and exhaust covers.
- (1) Refer to 72-00-25, para.11.



Checks and Remarks

CAUTION: FAILURE TO INSTALL THE ELECTRICAL HARNESS CORRECTLY WILL LEAD TO DAMAGE WHICH CAN RESULT IN SERIOUS AIRWORTHINESS PROBLEMS.

- E. Check the main electrical harness to ensure that the cable runs have adequate clearance and are clipped correctly as specified in the relevant procedure for the affected component.
- F. Ensure all electrical connections connected to services and accessories are wire-locked correctly, where applicable.



SPECIFICATION AND ANALYSIS - ENGINE TESTING

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SPECIFICATION AND ANALYSIS - ENGINE TESTING

General

This section details the operating limits, performance acceptance standards and the correction factors required to determine the acceptance of an engine following a performance test run (Ref. 72-00-27).

2. Operating Limitations

- A. Limiting Conditions on Test Bed.
 - (1) The limiting condition is the one reached first.

 Maximum conditions must not be exceeded. Any
 inadvertent excess and the duration of that
 excess must be recorded.
 - (2) In the event of overspeed limitations being exceeded, the engine must be shut down immediately. At low temperatures the N_1 shaft speed will be limited to a constant $N_1/\sqrt{9}$ (Ref.Fig.701).
 - (3) Steady running in the range 60 to 67 per cent N₂ is only permitted if 67 per cent N₂ has first been achieved. Steady running at speeds lower than 60 per cent N₂ is only permitted in the range 25 per cent to 32 per cent N₂ for the purpose of debowing the HP shaft.

| RATING | N _l per cent | N ₂ per cent | EGT deg C |
|--------------------|-------------------------|-------------------------|-----------|
| Maximum Idle | 101.5 | 105.8 60 (Minimum) | 777 |
| Start Overspeed | 108.5 | 110 | 560 |

Operating Limitations
Table 701

- B. Oil System Limitations.
 - (1) Temperature.
 - (a) Refer to Table 702 for oil system temperature limitations.



| | | TEMP LIMITATIONS AT STABILISED POWER CONDITIONS | | |
|---|-----------------------------------|---|-------|---------------|
| <u>STATION</u> | CONDITION | MINIMUM | deg C | MAXIMUM deg C |
| Engine oil inlet | Starts and accelera- | -10 | | |
| Engine oil inlet | Stabilized power conditions | 65 | • | 120 |
| Differential between HP turbine (No.4) bearing scavenge and the engine oil inlet (Pre SB 72-8800-311) | Stabilized power conditions | 55 | | 105 |
| Differential between oil scavenge and inlet at HP turbine (No.4) bearing (SB 72-8800-311 standard) | Stabilized power conditions | 50 | | 86 |
| Differential between HP turbine (No.4) bearing inlet and the engine oil inlet | Stabilized power conditions | 0 | | 5 |

Oil System Temperature Limitations Table 702



(2) Pressure.

| | | (a) | On engines to Pre-S.B.72-8562-146 and Pre-S.B.72-8525-188 standard at 90 per cent N ₂ and above | 22 + 1 psi |
|----|------|------|--|-----------------------|
| | | (b) | On engines to S.B.72-8562-146 standard at 90 per cent N ₂ and above | 13.5 <u>+</u> 3.5 psi |
| | | (c) | On engines to \$.8.72-8525-188 standard at 90 per cent N_2 and above | 26 <u>+</u> 1 psi |
| | | (d) | Maximum oil tank pressure, sea level/take-off | 5.5 psig |
| | | (e) | Minimum oil tank pressure, sea level/take-off | 3.5 psig |
| | | (f) | Low oil pressure switch setting | |
| | | | (i) Pre-S.B.72-8562-146 engines | 15 <u>+</u> 1 psi |
| | | | (ii) S.B.72-8562-146 standard engines | 7 <u>+</u> 2 psi |
| C. | Fuel | Syst | em Limitations. | |
| | (1) | Temp | erature. | |
| | | (a) | Maximum (second stage pump outlet) | 155 deg C |
| | | (b) | Minimum (engine inlet) | -40 deg C |
| | (2) | Pres | sure. | |
| | | (a) | Minimum (any condition) | 5.0 psig |
| | | (b) | Maximum (at max. take-off, reheat off) | 25.0 psig |



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ATP TEMPORARY REVISION

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OLYMPUS 593 OVERHAUL MANUAL

This Temporary Revision complies with BCAR's Chapter A6-2 and TSS No.0-2

Durin Hardall

For Chief Technical and Industrial Services Engineer CAA Design Approval No.DAI/8566/78

TEMPORARY REVISION NO.72-577

Insert in 72-00-29 before page 703

REASON FOR ISSUE

BEOL Testing additions

ACTION

Read the following as new paragraph E (3).

- (3) Calculating turbine entry temperature T8.
 - (a) Determine the intake mass air flow (W1 obs) in Ib/sec. as detailed in Table 704 from the flare depression.
 - (b) Determine the combustion mass flow (Wcc) Wcc = WI obs x 0.9204.
 - (c) Establish the fuel specific gravity (S.G.).
 - (d) Determine engine fuel flow (Fe) observed in Ib/sec. FE (Ib/sec.) = $\frac{\text{Fe (g.p.h.)}}{3600}$ X 10 x S.G.
 - (e) Determine fuel/air ratio (F/A) at the combustion chamber.

$$(F/A) = \frac{Fe (lb/sec.)}{Wcc (lb/sec.)}$$

(f) If C.V. = actual calorific value of fuel then

$$F/A$$
. (Actual) = $(F/A) \times \frac{C.V.}{10308}$

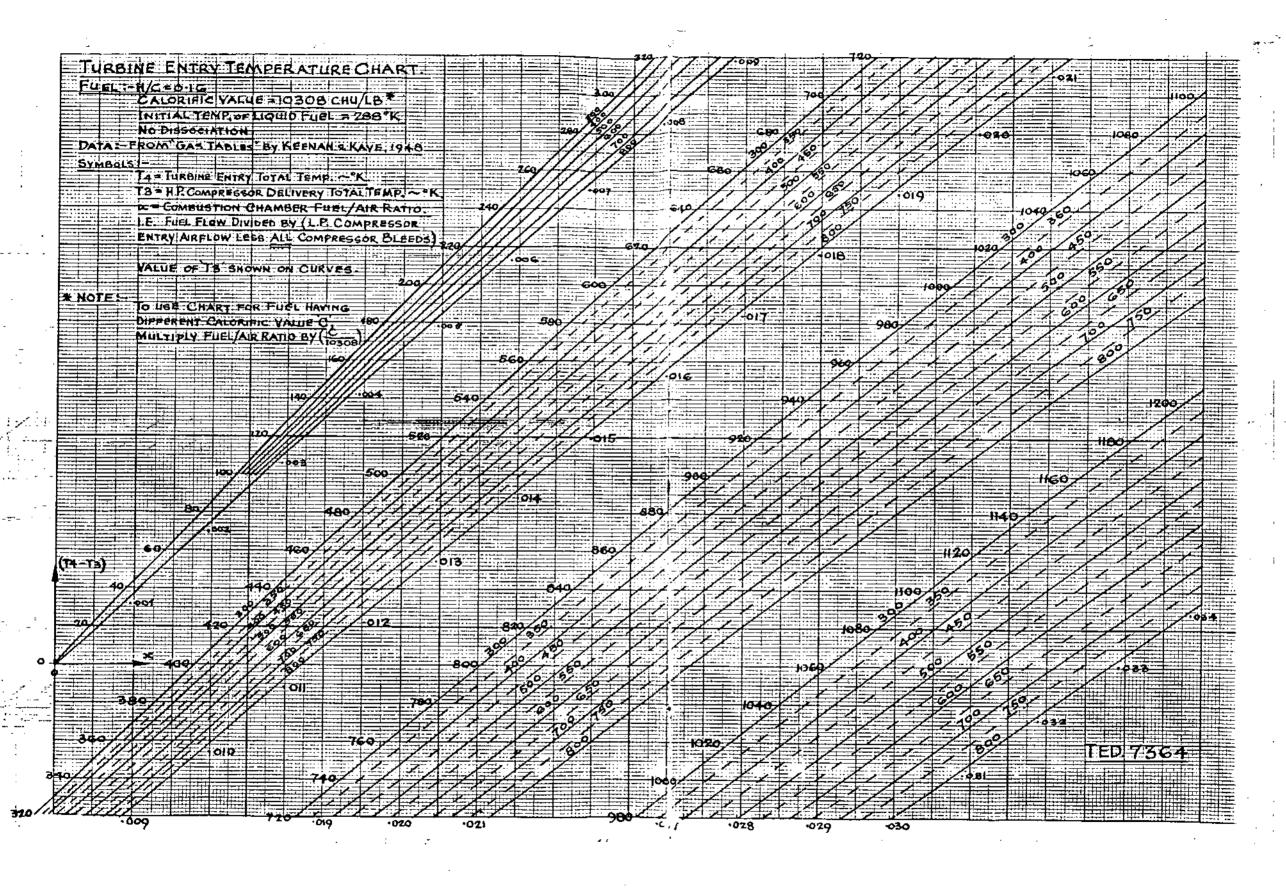
(g) From graph FIG.710 using F/A. (Actual) and H.P. compressor delivery temperature T7 OK. Determine the combustion temperature rise.

$$T = T8 - T7$$
 then $T8 \circ K = T + T7 \circ K$.

EXAMPLE - If F/A ratio = .025 and T7 = 500°K then from the graph (T8 - T7) = 885°K . . . T8 = 1385°K.

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23 July 1981



Turbine Entry Temperature Chart FIGURE 710

TR 72-577 72-00-29 TR Page 2 of 2 D. Air System Temperature Limitations.

| Station | <u>Limitation (deg C</u> Minimum |) at S/L T.O. Maximum |
|---|-------------------------------------|--------------------------------|
| LP and HP compressor (Nos.2 and 3) bearings cold vent | Refer to Fi | gure 707 |
| LP and HP turbine (Nos.4 and 5) bearings cold vent | Refer to Fi | gure 708 |
| LP turbine (No.5) bearing hot vent | Refer to Fi | gure 709 |
| HP turbine cooling | 400 | 515 at settled condition |
| * 530 (deg C) peak after accondition Air System Temper Table | ature Limitations | ised idle |
| Exhaust Gas Temperature (| EGT) Limitations. | |
| (1) Exḥaust gas limitati limitations (Ref.Tab | ons are recorded in o le 701). | perating |
| (2) Maximum circuit spre | ad ' 1 | Odeg C |
| . Vibration Limitations. | | |
| (1) No.1 bearing, vertic | al, filtered M | aximum |
| | | |
| (a) Starting | 5 | in./s |

(2) Recommended maximum DEVS recorded broadband vibration between idle and maximum rpm 2 in./s

(3) Recommended maximum DEVS recorded HP ordered vibration between idle and maximum rpm 1 in./s

(4) Recommended maximum DEVS recorded LP ordered vibration between idle and maximum rpm 1.25 in./s

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MK.610-14-28 snecm OVERHAUL

- (5) Maximum recommended DEVS recorded fuel pressure oscillation between 95%NH and maximum rpm 4.0 psi
- G. Idling Speed.

Ensure with the pilot's lever in idle gate the following conditions are obtained:

- (1) Minimum No = 5530 rpm corrected.
- (2) Maximum fuel flow = 378 gal/h.
- Acceptance Standards (Test Cell)
 - A. Performance Acceptance Standards.
 - (1) From the performance readings taken during the Performance Check procedure (Ref.72-00-27), evaluate mass flow, thrust and S.F.C. in accordance with paragraph 4, then check that minimum mass flow, thrust, maximum S.F.C. and Pt7 are within acceptable limits. Refer to Table 704.

| Rating | Corrected N1 rpm | _ | Minimum tandardised Mass Flow lb/sec (Kg/s) | S.F.C. | | Minimum Thrust lb |
|---------------------------------|------------------------|--------------------------------------|---|-------------------|--------------------|-------------------------|
| Take-off max, dry | 6250 | | 410 (185.94) 3) | - | (Ref.para. (3)) | (Ref. para. (2)) |
| Mach 2.0 cruise equivalen | 5600 t | As ob- tained on NOR contro | (164.22) MAL | (Ref. Fig.704) | | - |
| Max. con- tinuous | 6250 | 8530 correc ted | 410 - (185.94) | (Ref. Fig.704) | - | - |

Performance Acceptance Standards
Table 704

NOTE: 100 per cent $N_1 = 6500 \text{ rpm}$ 100 per cent $N_2 = 8530 \text{ rpm}$

TESTING

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- (2) Minimum acceptable thrust.
 - (a) Where $T\alpha$ is equal to, or less than, $10^{\circ}C$ $X \text{ (MIN)} = \left[31920 + (T \times 14)\right] \times \frac{P_{CELL}}{30}$
 - (b) Where $T \propto$ is greater than $10^{\circ}C$ $X (MIN) = \left[33060 - (T \times 100)\right] \times \frac{P_{CELL}}{30}$

Where X (MIN) = Minimum acceptable thrust (lbs) $T \propto$ = Ambient temperature ($^{\circ}$ C)

 P_{CELL} = Cell pressure (in. Hg).

- (3) Min and max acceptable exhaust annulus pressure (Pt7).
 - (a) Minimum acceptable Pt7

 Pt7(MIN) = $\left[\begin{pmatrix} X_{CORR} \times \frac{30}{P_{CELL}} \times .001505 \end{pmatrix} 4.31 \right] \times \frac{P_{CELL}}{30}$
 - (b) Maximum acceptable Pt7. Pt7(MAX) = $\left[{^{\text{X}}\text{CORR} \times \frac{30}{P_{\text{CELL}}} \times .00154} \right] \times \frac{P_{\text{CELL}}}{30}$

Where Pt7(MIN) = Minimum acceptable exhaust annulus pressure (in. Hg)

Pt7(MAX) = Maximum acceptable exhaust annulus pressure (in. Hg)

 X_{CORR} = Corrected engine thrust (1b)

 P_{CELL} = Cell pressure (in. Hg)

- B. Oil System Acceptance Standards.
 - (1) Low oil pressure switch setting
 - (a) Pre-S.B.72-8562-146 engines 15 ± 1 psi
 - (b) S.B.72-8562-146 standard engines

7 <u>+</u> 2 psi

(2) Maximum oil consumption

1.0 US quarts/h

(3) On engines to Pre-S.B.72-8562-146 and Pre-S.B.72-8525-188 standard at 90 per cent N2 and above

22 + 1 psi

(4) On engines to S.B.72-8562-146 standard at 90 per cent N_2 and above

13.5 <u>+</u> 3.5 psi

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| (5) | On engines to S.B.72-8525-188 | 26 <u>+</u> 1 psi |
|-----|--|-------------------|
| | standard at 90 per cent N ₂ | _ ` |
| | and above | |

(6) Maximum oil tank pressure (Sea level take-off)

5.5 psig

(7) Minimum oil tank pressure (Sea level take-off)

3.5 psig

C. Oil System Leakage Acceptance. .

NOTE: Oil leakage from any hot vent is unacceptable.

External leakage from lower anti-icing manifold is acceptable.

(1) Total oil leakage from right-hand gearbox hydraulic pump seals 2 cc

2 cc/min

(2) Interlabyrinth drain or intermediate casing (Avoid slam decelerations during measurement period)

6 cc/min

(3) No.1 bearing cold vent

300 cc/shut-down

(4) Leakage is permitted from the intermediate case No.4 vane up to

1 ml/min

D. Fuel System Acceptance Standards.

Recirculating valve energised at 80 per cent No observed

875 gal/h (nominal value)

E. Fuel System Leakage Acceptance.

NOTE: Oil leakage from fuel drains is not acceptable.

Maximum leakage allowed

(1) 1st stage pump shaft seal 12 cc/min

(2) 2nd stage turbo pump shaft seal 12 cc/min

(3) Fuel control unit shaft seal 12 cc/min

(4) Static seal drains NIL

NOTE: The above limits apply when 'press-to-test' check indicates a leakage and apply only to individual drains.

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4. Correction Factors

- A. General.
 - (1) Before evaluation of engine performance can be carried out, the following effects associated with specific test cells and test equipment must be resolved:
 - (a) Air intake and flow straightener losses.
 - (b) External drag forces on the engine body and test cradle.
 - (c) Exhaust detuner suction effect.
 - (d) Air intake flow straightener effect on nozzle pressure ratio.
 - (2) The effects are normally measured during the initial test cell commissioning.
- B. Environmental Corrections.
 - (1) Air intake and flow straightener losses.
 - (a) Evaluate cell pressure (P cell)
 P cell (in. Hg) = Barometric reading
 (in. Hg) cell depression (in. Hg)
 NOTE: in. Hg = inches Perchloroethylene x 0.12.
 - (b) Evaluate P₁ (total pressure at engine face) as follows:
 - (i) Correct the intake depression in inches of Perklone x $(\frac{30}{(P \text{ cell})})$
 - (ii) Apply cabin temperature corrections (Ref. Fig. 702).
 - (iii) Obtain the corrected mass flow for the relevant intake depression.
 - (iv) Evaluate: $\frac{W_1 \text{ obs } \sqrt{T_1 + 273}}{P \text{ cell x 0.49}}$ = $W_1 \text{ corr x } \frac{P \text{ cell x}}{30} \times \sqrt{\frac{288}{T_1 + 273}} \times \sqrt{\frac{T_1 + 273}{2000 \times 1000}}$ = 1.155 $W_1 \text{ corr}$
 - (v) Use the relevant curve for the specific test bed to determine the function:

$$\frac{(P cell - P_l) \times 100}{(P cell)}$$

(vi) Then
$$P_1 = P \text{ cell } \times \begin{bmatrix} 1 - (P \text{ cell } - P_1) \\ (P \text{ cell }) \end{bmatrix}$$

- (2) External drag forces acting upon the engine body and test cradle.
 - (a) Evaluate as follows:

Calculated drag force (lb) = per cent thrust
Thrust measured (lb) loss

(b) This function plotted against N_2 is given on the relevant graph for the specific test bed.

NOTE: Corrected N₂ = Observed N₂ x $\sqrt{\frac{288}{T_1 + 273}}$ (Ref.Table 705)

Where $N_2 = HP rpm$

- (c) Read off relevant percentage drag and record.
- (3) Thrust loss due to detuner suction.
 - (a) Evaluate as follows:

Nozzle drag force (lb) = per cent thrust loss
Thrust measured (lb)

(b) This function is plotted against mass flow on the relevant graph for the specific test bed.

NOTE: Uncorrected mass flow (lb/s) x T₁ + 273

P cell x 0.49

= cell flow function

- (c) Read off the relevant percentage suction drag and record.
- (d) Add the two percentage drag forces determined in this paragraph and previous (Ref.para.4.B.(2)) together. This total percentage is referred to as (\underline{dx}) (x).

NOTE: The effects of the preceding paragraphs (Ref.paras.4.B.(2) and (3)) can alternatively be obtained from the initial test cell commissioning/cross-calibration graphs and tables.

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(4) Air intake flow straightener, effect on thrust.

Evaluate as follows:

(a) The effect of the air intake flow straightener on the intake pressure loss and the nozzle pressure ratio is combined in factors K_O which is determined by:

$$K_O = 1 + \frac{(P \text{ cell} - P1)}{(P \text{ cell})} \times (1 + f. Pt7 \text{ corrected})$$

(b) Where: Pt7 = exhaust annulus total pressure (psia) Pt7 corrected = (Pt7 observed + barometric (psi)) x $\frac{30}{P_1}$

f. Pt7 = function of Pt7 as derived
 from graph (Ref.Fig.705)

- C. Correction of Observed Results.
 - (1) Compressor speeds (LP and HP).
 - (a) N₂ corrected = HP rpm observed $\times \sqrt{\frac{288}{T_1 + 273}}$ (Ref.Table 705).

NOTE: Ensure that the corrected Ni is as specified in the performance check, i.e. within ± 10 rpm.

- (b) N₁ corrected = LP rpm observed $x \sqrt{\frac{288}{T_1 + 273}}$ (Ref.Table 705).
- (c) If N_1 corrected is outside the limits, repeat the test points.
- (2) Fuel flow corrections (F_E) .
 - (a) Establish the specific gravity of the fuel for the prevailing fuel inlet temperature (Ref.Fig.706).

(b) Convert the fuel flow from gal/h to lb/h.

NOTE: Fuel flow (lb/h) = fuel flow (gal/h) x S.G. x 10.

(c) Correct the fuel flow.

NOTE: Fuel flow, corrected = observed fuel flow x P cell P1

- (d) Record the corrected fuel flow.
- (3) Thrust correction (X corrected).
 - (a) Corrected thrust = observed thrust $x \in (1 + \frac{dx}{x})$
 - (b) K_0 = correction for intake pressure loss effects. Refer to graph (Ref.Fig.705).
 - (c) (\underline{dx}) = detuner suction and entrainment (\overline{x}) (engine body) drag added together.
- (4) Specific fuel consumption correction (S.F.C.) corrected).

S.F.C. corrected = (Fuel flow lb/h corrected)
(Total thrust corrected)

- (5) Mass flow correction (W corr). W corrected = W observed x $\frac{30}{P_1}$ x $\sqrt{\frac{T_1 + 273}{288}}$
- (6) Pt7 standardised.

Pt7 standardised = (Pt7 observed + P barometric) $\times \frac{P \text{ cell}}{P}$

- D. Performance Evaluation Procedure.
 - (1) Record the following parameters during the performance curve check points as detailed during performance check (Ref.72-00-27).



- (a) Observed LP rpm (N1).
- (b) Observed HP rpm (N2).
- (c) Barometric pressure, inches of mercury (Hg) corrected to 15 deg C.
- (d) Observed fuel flow (gal/h).
- (e) Observed jet pipe temperature, record in deg C.
- (f) Air intake temperature (T_a), record in deg C. NOTE: On the test bed T_a is assumed to equal T_1 .
- (g) Observed fuel inlet temperature at engine inlet, record in deg C.
- (h) Observed thrust, record in pounds (lb).
- (j) Observed air intake depression, record in inches perchloroethylene.
- (k) Exhaust annulus (Pt7) total pressure, record in psi.
- (1) Observed cell depression (inch perchloroethylene).
- (2) Performance calculations (Ref. Table 706).
 - (a) Record the parameters taken during the performance check as detailed in the previous paragraph (Ref.para.4.D.(1)) in the appropriate spaces on the performance calculation sheet.
 - (b) Record the test cell corrections for the specific test cell as detailed on the performance calculation sheet.
 - (c) Perform calculations as instructed by the performance calculation sheet.
- (3) Enter the figures, obtained from the performance calculations, on the performance acceptance values sheet (Ref. Table 707) and check that they are within the acceptance limits of paragraph 3.

5. Accessory Loadings

A. Pneumatic Starter (Semca 1052).

- (1) Air pressure supply.
 - (a) Maximum

35 psig.

(b) Minimum

28 psig.

- (2) Air temperature supply.
 - (a) Maximum

300 deg C.

- (3) Motoring cycles.
 - (a) Regulate air supply so that 16 per cent N2 is not exceeded.
 - (b) Maximum cycle duration 30 seconds.
- (4) Speed Limitations during starts (dead cranks).
 - (a) Maximum

16 per cent N2.

(b) Minimum

14 per cent N₂.

- B. Integrated Drive Generator (When Installed).
 - (1) Power output limitations.
 - (a) Maximum continuous

96 hp.

- (b) Maximum 5 minute limit 150 hp.
- (c) Maximum 6 second limit 200 hp.
- (2) Oil temperature limitations (rise across IDG).
 - (a) Maximum continuous up to 30 kW

23 deg C.

(b) At 60 kW load

35 deg C.



- 6. <u>Compressor Bleeds</u> (Information only)
 - A. Anti-icing
- 0.6 tb/s (normal/max).
- B. Turbo Pump
- A function of N2 and fuel flow.
- C. Fuel Heater (when operational)
- 2.8 lb/s (normal/max).
- 7. Engine Run-down Times
 - A. Conditions
 - (1) The engine must have run for at least 10 minutes at not less than 100% N₂ prior to normal stopping procedure.
 - B. Limits
 - (1) HP (N₂) spool run-down time ... 160 seconds (minimum)
 - (2) LP (N₁) spool run-down time ... 200 seconds (minimum)

NOTE: In some cases rundown times for the LP spool of between 170 seconds and 200 seconds may be acceptable provided it can be shown that the average rundown time is increasing. If labyrinth seal abradable coatings have been repaired and significant traces of the coating material are found in any of the oil filters, the oil should be dumped at the end of the test and the engine flushed through with fresh oil.



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| T _a (°C) | $\sqrt{\frac{288}{T_a + 273}}$ | T_a (°C) $\sqrt{\frac{288}{T_a + 273}}$ |
|---------------------|--------------------------------|---|
| - 6 | 1.0386 | 15 1.0000 |
| - 5.5 | 1.0376 | 15.5 0.9991 |
| - 5 | 1.0366 | 16 0.9983 |
| -4.5 | 1.0357 | 16.5 0.9974 |
| -4 | 1.0347 | 17 0.9966 |
| -3.5 | 1.0337 | 17.5 0.9957 |
| -3 | 1.0328 | 18 0.9948 |
| -2. 5 | 1.0318 | 18.5 0.9940 |
| -2 | 1.0309 | 19 0.9932 |
| -1. 5 | 1.0299 | 19.5 0.9923 |
| -1 | 1.0290 | 20 0.9915 |
| - 0.5 | 1.0280 | 20.5 0.9906 |
| 0 | 1.0271 | 21 0.9898 |
| 0.5 | 1.0262 | 21.5 0.9889 |
| 1 | 1.0253 | 22 0.9881 22.5 0.9872 |
| 1.5 | 1.0243 | 22.5 0.9872 |
| 2 | 1.0233 | 23.5 0.9855 |
| 2.5 | 1.0224 | 24 0.9847 |
| 3 | 1.0215 | 24.5 0.9839 |
| 3.5 | 1.0206 | 25 0.9831 |
| 4 4.5 | 1.0197 1.0188 | 25.5 0.9822 |
| 5 | 1.0179 | 26 0.9814 |
| 5.5 | 1.0169 | 26.5 0.9806 |
| 6 | 1.0160 | 27 0.9798 |
| 6.5 | 1.0151 | 27.5 0.9790 |
| 7 | 1.0142 | 28 0.9782 |
| 7.5 | 1.0133 | 28.5 0.9774 |
| 8 | 1.0124 | 29 0.9766 |
| 8.5 | 1.0115 | 29.5 0.9758 |
| 9 | 1.0106 | 30 0.9750 |
| 9.5 | 1.0097 | 30.5 0.9742 |
| 10 | 1.0088 | 31 0.9734 |
| 10.5 | 1.0079 | 31.5 0.9726 32 0.9718 |
| 11 | 1.0071 | |
| 11.5 | 1.0062 | 32.5 0.9710 33 0.9702 |
| 12 | 1.0053 | 33.5 0.9694 |
| 12.5 | 1.0044 | 34 0.9686 |
| 13 | 1.0035 | 34.5 0.9678 |
| 13.5 14 | 1.0026 | 35 0.9670 |
| 14.5 | 1.0018 1.0009 | |
| 74.3 | 1.0009 | |

Temperature Correction Factors
Table 705

TESTING

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| Į I | INE | ITEM | | INSTRUCTION | 1.1 | 1.2 | 2.1 |
|-----|-----|---|----------|---|-------------------------------|-----|--------------|
| ı | 1 | SCHEDULE CONDITION | | CORR. N ₁ CORR. N ₂ | 5600 Max A _J | | 6250 T.O. |
| | 2 | TEST POINT | | | | | |
| | 3 | THRUST X | 1b | INSTRUMENT CORRECTED | | | |
| | 4 | Тj | deg C | | | | |
| | 5 | N _l OBS | rpm | | | | |
| | 6 | N ₂ OBS | rpm | | | | |
| | 7 | T ₁ | deg C | | | | |
| | 8 | BAROMETRIC READING | in. Hg | CORRECTED TO 15 deg C | | | |
| | 9 | Pt7 GAUGE | psi | | - | - | |
| | 10 | FUEL FLOW | G.P.H. | | | | _ |
| | 11 | FUEL INLET TEMPERATURE | deg C | | | | - |
| ŀ | 12 | FUEL S.G. | | AT FUEL TEMPERATURE (Ref.Fig.706) | | | - |
| | 13 | $\sqrt{\frac{288}{\text{Ta} + 273}}$ | | (Ref. Table 705) | | | |
| | 14 | N ₁ CORRECT- ED TO ISA RPM | | LINE 5 x LINE 13 | | | |
| | 15 | N ₂ CORRECT- ED TO ISA RPM | | LINE 6 x LINE 13 | - | | - |
| | 16 | CELL DEPRESSION | in. Perk | | | | |

Performance Calculation Sheet Table 706 (Continued)

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CONCORDE

OLYMPUS 593 OVERHAUL MANUAL

TEMPORARY REVISION No. 72-503
Insert in 72-00-29 Testing before Page 715 (MRA 46)

REASON FOR ISSUE:

To reinstate in the Manual the Air Mass Flow/Flare Depression Chart that was removed by Rolls-Royce as a result of a decustomerisation policy.

Rolls-Royce have confirmed the validity of the originally issued charts with respect to the flare RL.137188 currently in use at BEOL.

Rolls-Royce Telex Ref: 1743 VAG/D. Evans, dated 18 January 1979 refers.

ACTION:

Amend Line 20 to read:

20 Wl Corr. - lb/s - from Line 19 read Wl Corr. from Following Table:

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| <u> </u> | <u>-</u> | | | <u> </u> | | |
|-----------------|--------------|----------|-------|----------------|-------|-------------|
| in. Perklone | · O . | 0.1 | 0.2 | 0.3 | 0.4 | |
| | · | <u> </u> | | | | |
| 0 | 0.0 | 22.8 | 32.3 | 39.5 | 45.6 | |
| 1 | 72.0 | 75.6 | 78.9 | 82.1 | 85.2 | |
| 2 | 101.7 | 104.2 | 106.6 | 109.0 | 111.3 | |
| . 3 4 | 124.3 | 126.3 | 128.3 | 130.2 | 132.2 | |
| . 4 | 143.2 | 144.9 | 146.6 | 148.3 | 150.0 | |
| 5 | 159.7 | 161.3 | 162.8 | 164.3 | 165.8 | |
| 5 | 174.6 | 176.0 | 177.4 | 178.8 | 180.2 | |
| 7 | 188.2 | 189.5 | 190.7 | 192.0 | 193.3 | |
| 8 | 7200.7 | 201.9 | 203.1 | 204.3 | 205.5 | |
| 9 | 212.4 | 213.5 | 214.7 | 215.8 | 216.9 | - · |
| 10 | 223.4 | 224.5 | 225.5 | 226.6 | 227.6 | |
| 11 | 233.8 | 234.8 | 235.8 | 236.8 | 237.8 | - |
| 12 | 243.6 | 244.6 | 245.5 | 246.5 | 247.4 | |
| 13 | 253.0 | 253.9 | 254.8 | 255.7 | 256.6 | |
| 14 | 261.9 | 262.8 | 263.7 | 264.6 | 265.4 | |
| ⇒ 1 5 | 270.5 | 271.4 | 272.2 | 273.0 | 273.9 | |
| 16 | 278.8 | 279.6 | 280.4 | 281.2 | 282.0 | - |
| 17 | 286.7 | 287.4 | 288.2 | 289.0 | 289.8 | |
| 18 | 294.3 | 295.0 | 295.8 | 296.5 | 297.3 | |
| 19 | 301.7 | 302.4 | 303.1 | 303.8 | 304.5 | |
| 20 | 308.8 | 309.5 | 310.2 | 310.9 | 311.6 | |
| 21 | 315.7 | 316.3 | 317.0 | 317.7 | 318.4 | |
| 22 | 322.3 | 323.0 | 323.6 | 324.3 | 324.9 | |
| 23 | 328.8 | 329.4 | 330.1 | 330.7 | 331.3 | |
| 24 | 335.1 | 335.7 | 336.3 | 336.9 | 337.5 | |
| 25 | 341.2 | 341.8 | 342.4 | -342-9 | 343.5 | |
| 26 | 347.1 | 347.7 | 348.2 | 348.8 | 349.4 | |
| 27 | 352.8 | 353.4 | 354.0 | 354.5 | 355.1 | |
| 28 | 358.4 | 359.0 | 359.5 | 360.1 | 360.6 | |
| 29 | 363.9 | 364.4 | 365.0 | 365.5 | 366.0 | |
| 30 | 369.2 | 369.7 | 370.3 | 370.8 | 371.3 | |
| . 31 | 374.4 | 374.9 | 375.4 | 375.9 | 376.4 | À |
| 32 | 379.4 | 379.9 | 380.4 | 380.9 | 381.4 | 14 |
| 33 | 384.4 | 384.8 | 385.3 | 3.85.8 | 386.3 | |
| | 389.2 | 389.6 | 390.1 | 390.6 | 391.1 | |
| 34 | 393.9 | 394.3 | 394.8 | 395.2 | 395.7 | |
| 35 | 398.4 | 398.9 | 399.3 | 393.2 399.8 | 400.2 | |
| 36 | | | | | | • |
| 37 | 402.9 | 403.3 | 403.8 | 404.2 | 404.7 | |
| 38 | 407.3 | 407.7 | 408.1 | 408.6 | 409.0 | |
| . 39 · | 411.5 | 412.0 | 412.4 | 412.8 | 413.2 | |
| 40 | 415.7 | 416.1 | 416.5 | 416.9 | 417.4 | • |

Air Mass Flow/Venturi Depression (For Flares RL 137188 and RL 137278) Table 706 (Continued) (Sheet 1 - LH)

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| in. erklone | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | |
|----------------|----------------|-------|-------|-------|--------|---|
| 0 | 51.0 | 55.9 | 60.3 | 64.5 | 68.4 | |
| 1 | 88.2 | 91.0 | 93.8 | 96.5 | 99.1 | |
| 2 3 | 113.6 | 115.8 | 118.0 | 120.1 | 122.2 | |
| 3 | 134.1 | 135.9 | 137.8 | 139.6 | 141.4 | • |
| 4 | 151.7 | 153.3 | 155.0 | 156.6 | 158.2 | |
| 5 6 | 167.3 | 168.8 | 170.3 | 171.7 | 173.2 | - |
| 6 | 181.5 | 182.9 | 184.2 | 185.5 | 186.8 | |
| · 7 | 194.5 | 195.8 | 197.0 | 198.3 | 199.5 | |
| 8 | 206.7 | 207.8 | 209.0 | 210.1 | 23.1.3 | |
| 9 | 218.0 | 219.1 | 220.2 | 221.3 | 222.3 | |
| 10 | 228.7 | 229.7 | 230.7 | 231.7 | 232.8 | |
| 11 | 238.8 | 239.7 | 240.7 | 241.7 | 242.7 | |
| 12 | 248.4 | 249.3 | 250.2 | 251.2 | 252.1 | |
| 13 | 257.5 | 258.4 | 259.3 | 260.2 | 261.1 | |
| 14 | 266.3 | 267.1 | 268.0 | 268.8 | 269.7 | |
| 15 | 274.7 | 275.5 | 276.3 | 277.1 | 277.9 | |
| 16 | 282.8 | 283.5 | 284.3 | 285.1 | 285.9 | |
| 17 | 290.5 | 291.3 | 292.0 | 292.8 | 293.6 | |
| 18 | 298.0 | 298.7 | 299.5 | 300.2 | 300.9 | |
| 19 | 305.2 | 306.0 | 306.7 | 307.4 | 308.1 | |
| 20 | 312.2 | 312.9 | 313.6 | 314.3 | 315.0 | |
| 21 | 319.0 | 319.7 | 320.3 | 321.0 | 321.7 | , |
| 22 | 325.6 | 326.2 | 326.9 | 327.5 | 328.2 | |
| 23 | 331.9 | 332.6 | 333.2 | 333.8 | 334.4 | |
| 24 | 338.1 | 338.7 | 339.3 | 340.0 | 340.6 | |
| 25 | 344.1 | 344.7 | 345.3 | 345.9 | 346.5 | |
| 26 | 350.0 | 350.5 | 351.1 | 351.7 | 352.3 | |
| 27 | 355.7 | 356.2 | 356.8 | 357.3 | 357.9 | |
| 28 | 361.2 | 361.7 | 362.3 | 362.8 | 363,4 | |
| 29 | 366.6 | 367.1 | 367.6 | 368.2 | | |
| 30 | 371.8 | 372.3 | 372.8 | 373.4 | 368.7 | |
| 31 | 376.9 | 377.4 | 377.9 | 378.4 | 373.9 | |
| 32 | 381.9 | 382.4 | 382.9 | 383.4 | 378.9 | |
| 33 | 386.8 | 387.3 | 387.7 | | 383.9 | |
| · 34 | 391.5 | | | 388.2 | 388.7 | |
| 35 | 396.2 | 392.0 | 392.5 | 392.9 | 393.4 | |
| | | 396.6 | 397.1 | 397.5 | 398.0 | |
| 36 | 400.7 | 401.1 | 401.6 | 402.0 | 402.5 | |
| 37 | 405.1 | 405.5 | 406.0 | 406.4 | 406.8 | |
| 38 | 409.4 | 409.8 | 410.3 | 410.7 | 411.1 | |
| 39 40 | 413.6 417.8 | 414.1 | 414.5 | 414.9 | 415.3 | |

Air Mass Flow/Venturi Depression
(For Flares RL 137188 and RL 137278)
Table 706 (Continued) (Sheet 1 - RH)

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| in. | | <u>\</u> | • | | | * |
|----------|-------|----------|-------|-------|-------|---|
| Perklone | 0 | 0.1 | 0.2 | 0.3 | 0.4 | |
| 41 | 419.8 | 420.2 | 420.6 | 421.0 | 421.4 | |
| 42 | 423.8 | 424.2 | 424.6 | 425.0 | 425.3 | |
| 43 | 427.7 | 428.1 | 428.4 | 428.8 | 429.2 | |
| 44 | 431.5 | 431.9 | 432.2 | 432.6 | 433.0 | |
| 45 | 435.2 | 435.6 | 435.9 | 436.3 | 436.7 | |
| 46 | 438.8 | 439.2 | 439.6 | 439.9 | 440.3 | |
| 47 | 442.4 | 442.8 | 443.1 | 443.5 | 443.8 | - |
| 4.8 | 445.9 | 446.2 | 446.6 | 446.9 | 447.3 | |
| 49 | 449.3 | 449.6 | 450.0 | 450.3 | 450.6 | |
| 50 | 452.6 | 452.9 | 453.3 | 453.6 | 453.9 | |
| 51 | 455.9 | 456.2 | 456.5 | 456.8 | 457.2 | • |
| | | | | | | |

Air Mass Flow/Venturi Depression (For Flares RL 137188 and RL 137278) Table 706 (Concluded) (Sheet 2 - LH)

| in. Perklone | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | |
|-----------------|-------|-------|-------|-------|-------|-----|
| 41 | 421.8 | 422,2 | 422.6 | 423.0 | 423.4 | |
| 42 | 425.7 | 426.1 | 426.5 | 426.9 | 427,3 | |
| 43 | 429.6 | 430.0 | 430.3 | 430.7 | 431.1 | |
| 44 | 433.3 | 433.7 | 434.1 | 434.5 | 434.8 | |
| 45 | 437.0 | 437.4 | 437.8 | 438.1 | 438.5 | |
| 46 | 440.6 | 441.0 | 441.3 | 441.7 | 442.0 | ₹, |
| 47 | 444.2 | 444.5 | 444.8 | 445.2 | 445.5 | , T |
| 48 | 447.6 | 447.9 | 448.3 | 448.6 | 449.0 | |
| 49 | 451.0 | 451.3 | 451.6 | 452.0 | 452.3 | |
| 50 | 454.3 | 454.6 | 454.9 | 455.2 | 455.6 | |
| 51 | 457.5 | 457.8 | 458.1 | 458.4 | 458.7 | |

Air Mass Flow/Venturi Depression (For Flares RL 137188 and RL 137278) Table 706 (Concluded) (Sheet 2 - RH)







| LINE | ITEM | | INSTRUCTION | 1.1 | 1.2 | 2.1 |
|------|---------------------------------|----------|---------------------------------------|------|-------|----------|
| 17 | P CELL | in. Hg | LINE 8 - (0.12 x LINE 16) | | | <u> </u> |
| 18 | VENTURI DEPRESSION | in. Perk | | | | |
| 19 | CABIN TEMPERATURE | deg C | | | | |
| 20 | CABIN TEMPER CORRECTION | ATURE | (Ref.Fig.702) | | | |
| 21 | PV CORR. | in. Perk | LINE 18 x LINE 20 x 30/LINE 17 | | | |
| 22 | W ₁ CORR. | lb/s | Refer to the specific test cell chart | | | |
| 23 | P ₁ /P CELL | | | | d tes | |
| 24 | W ₁ STD | lb/s | LINE 22/LINE 23 | | | |
| 25 | FE | lb/h | (LINE 10 x LINE 12 x 10)/LINE 23 | | | , |
| 26 | K _O x K ₁ | | Test Bed Thrust Corrections | cell | d tes | |
| 27 | XG TEST BED CORRECTED | lb. | LINE 3 x LINE 26 | | | • |
| 28 | SFC | lb/h/lb | LINE 25/LINE 27 | | | - |
| 29 | Pt7 STD | psi | (LINE 9 + (0.49 LINE 8))/LINE 23 | _ | - | |

Performance Calculation Sheet Table 706 (Concluded)

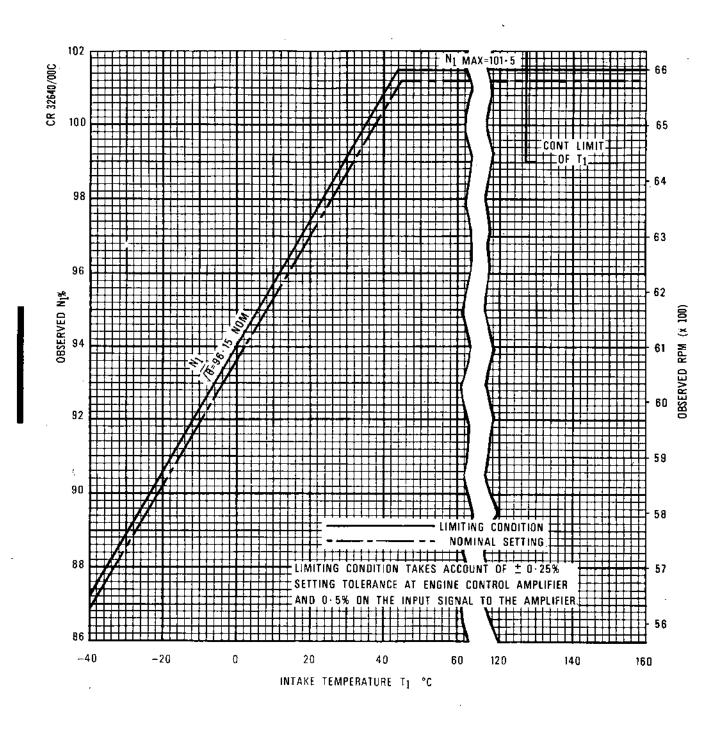
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| | | TAKE-OFF MAX (DRY) 2.1 | MAXIMUM CONTINUOUS 1.2 | CRUISE EQUIVALENT 1.1 |
|---|--|------------------------------|------------------------------|-----------------------------|
| | \mathbf{r}_1 | | | |
| _ | P cell | | | |
| 1 | W_1 Standardised Min W_1 Standardised Actu | al | | |
| | Thrust Min Thrust Actual | | - - | |
| | SFC Max SFC Actual | = | | • |
| | Pt7 Min Pt7 Actual Pt7 Max | | - - - | - - - |
| | | | | Ü |

Performance Acceptance Values
Table 707

TN32611



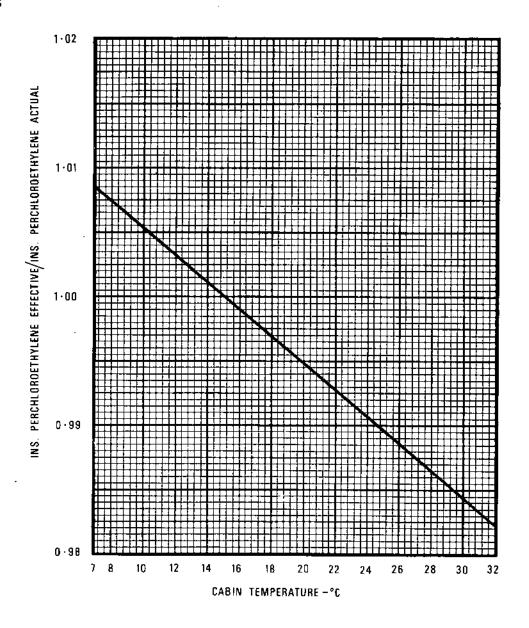


N1 Limitation and Maximum Governor Setting Figure 701

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34.24

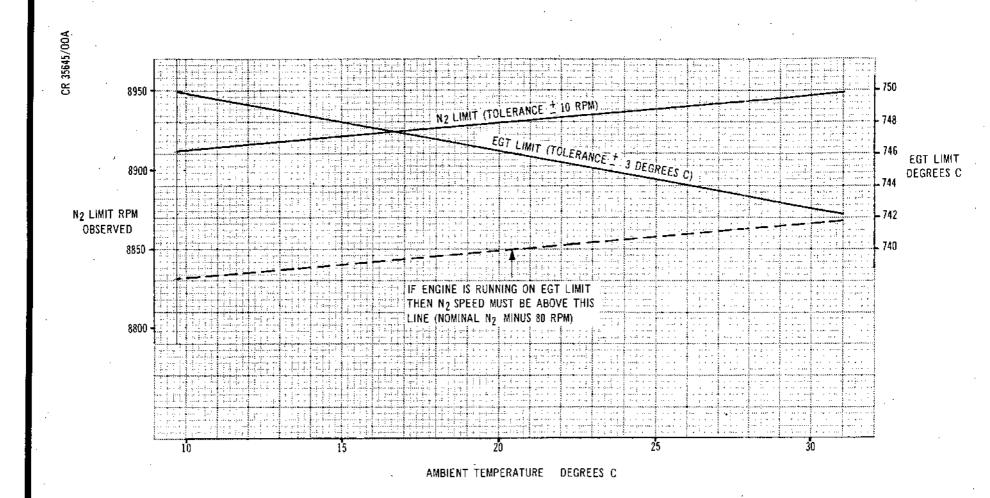
OVERHAUL



Correction for Variation of Manometer Perchloroethylene Density with Temperature Figure 702

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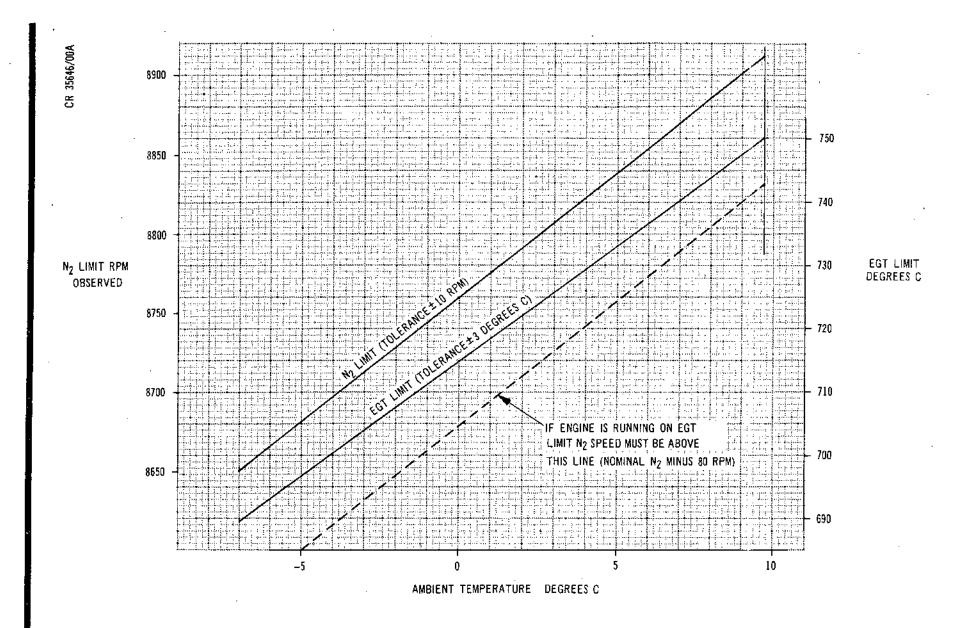
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 ${
m N_2}$ and Exhaust Gas Temperature Limitations Figure 703 (Sheet 1 of 2)

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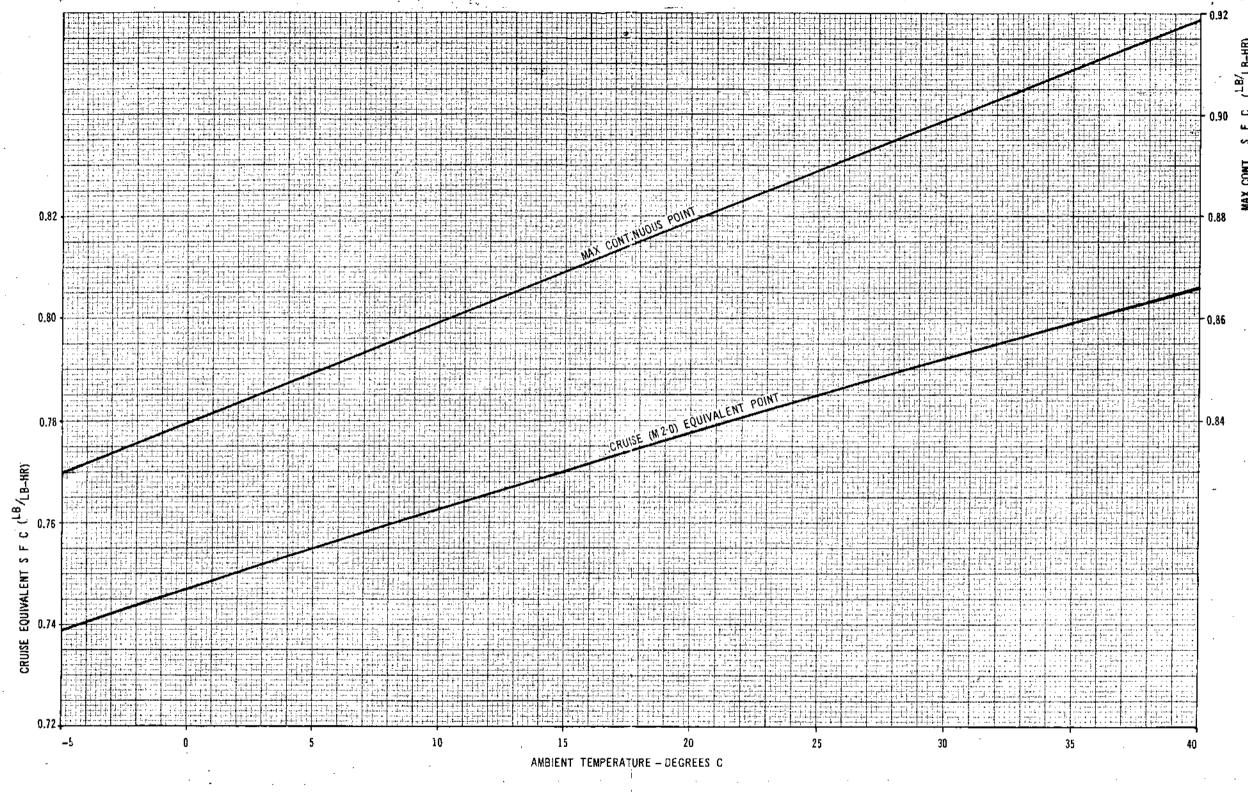




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m N_2}$ and Exhaust Gas Temperature Limitations Figure 703 (Sheet 2 of 2)

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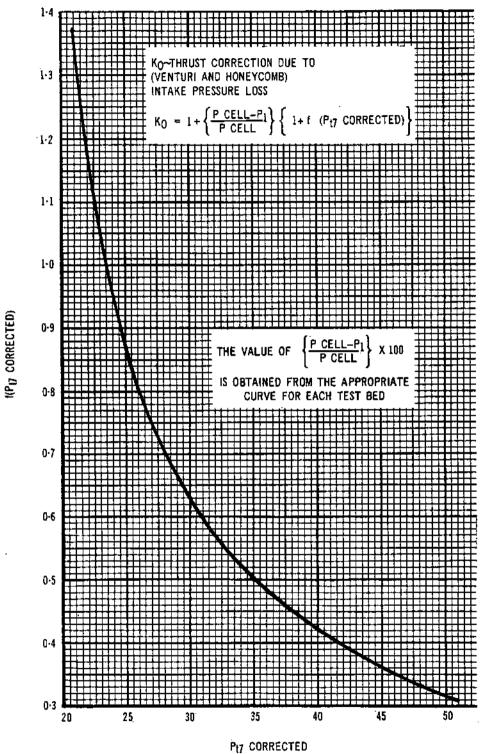
Maximum Specific Fuel Consumption Acceptance Figure 704

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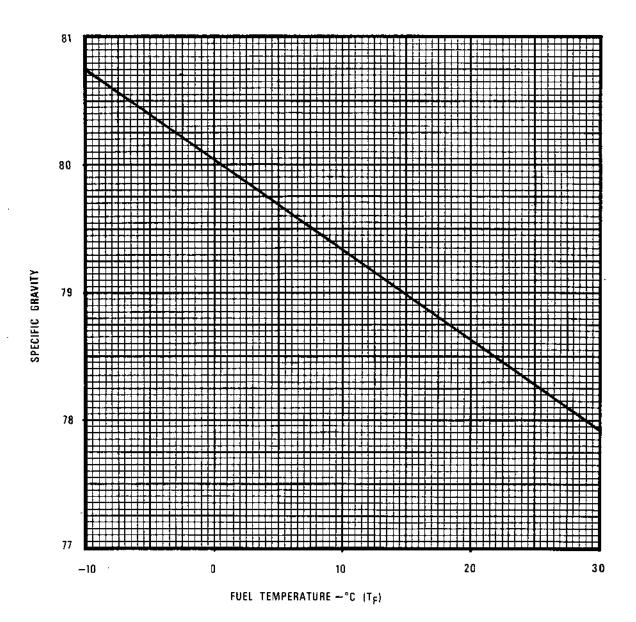
CR 32611/00B



Thrust Correction Figure 705

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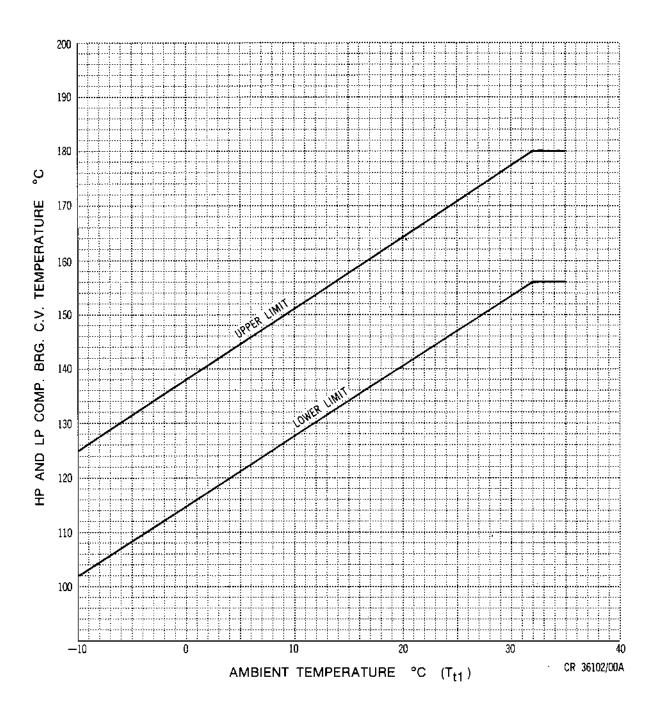
Page 725 Sep 1/80



FUEL SPECIFIC GRAVITY CORRECTION

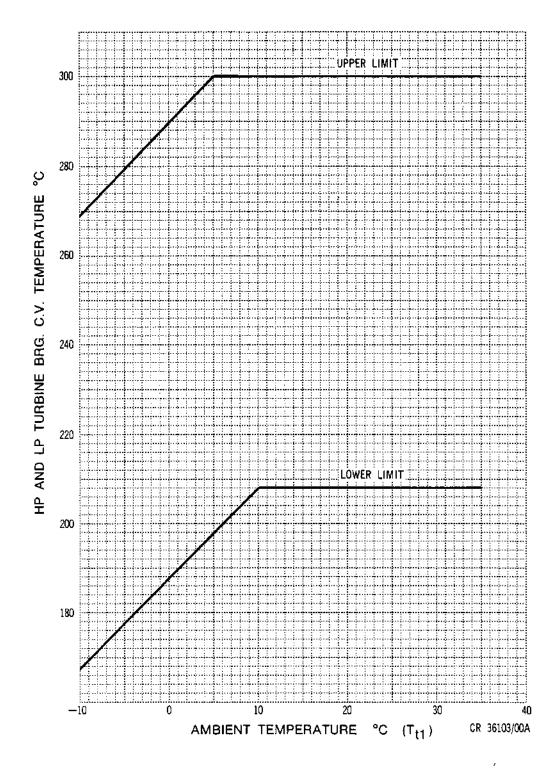
Fuel Specific Gravity Correction (Avtur) Figure 706

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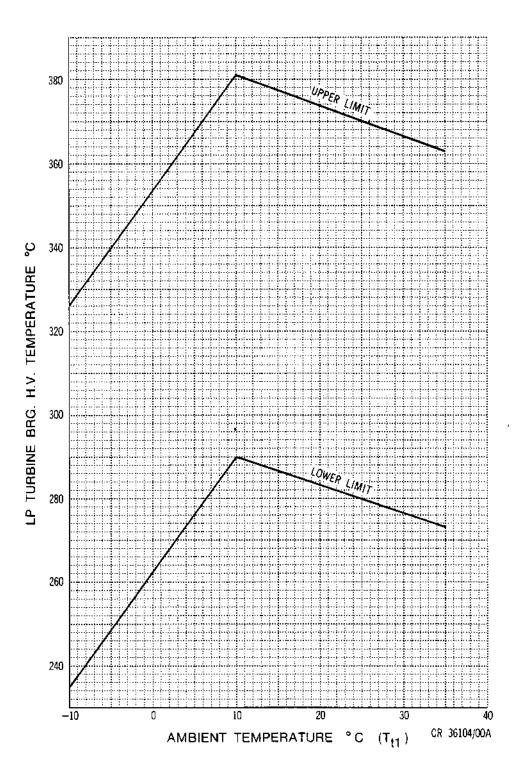


HP and LP Compressor Bearing Cold Vent Limitations Figure 707

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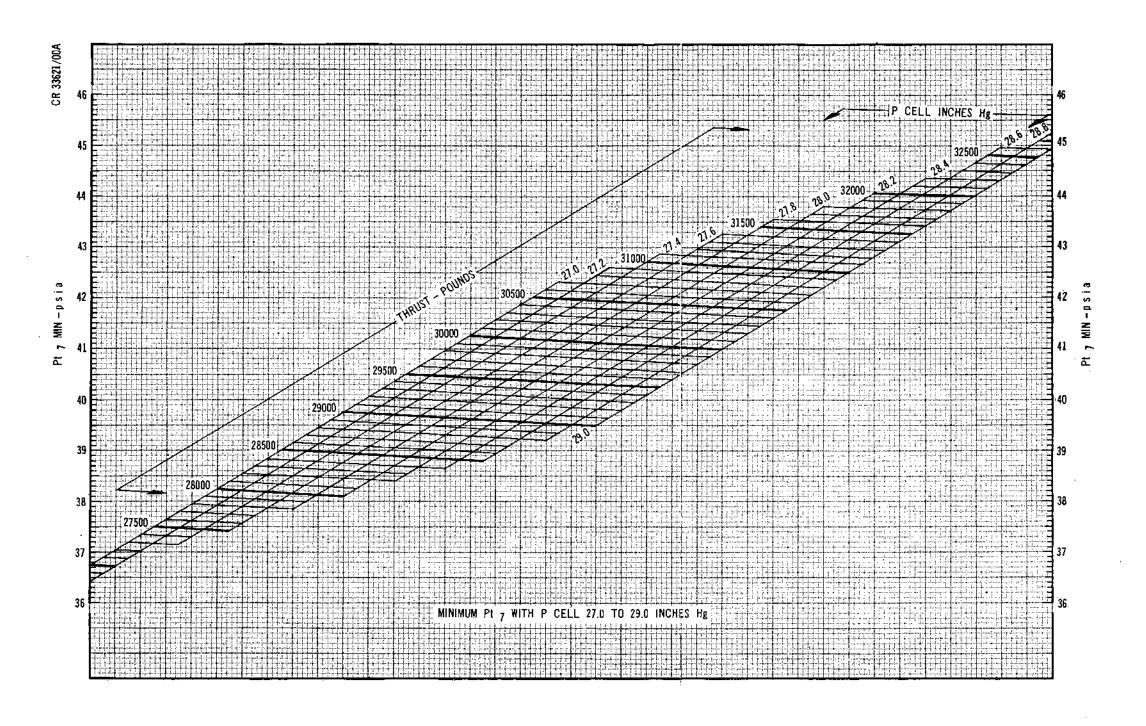


HP and LP Turbine Bearing Cold Vent Limitations Figure 708



LP Turbine Bearing Hot Vent Limitations Figure 709

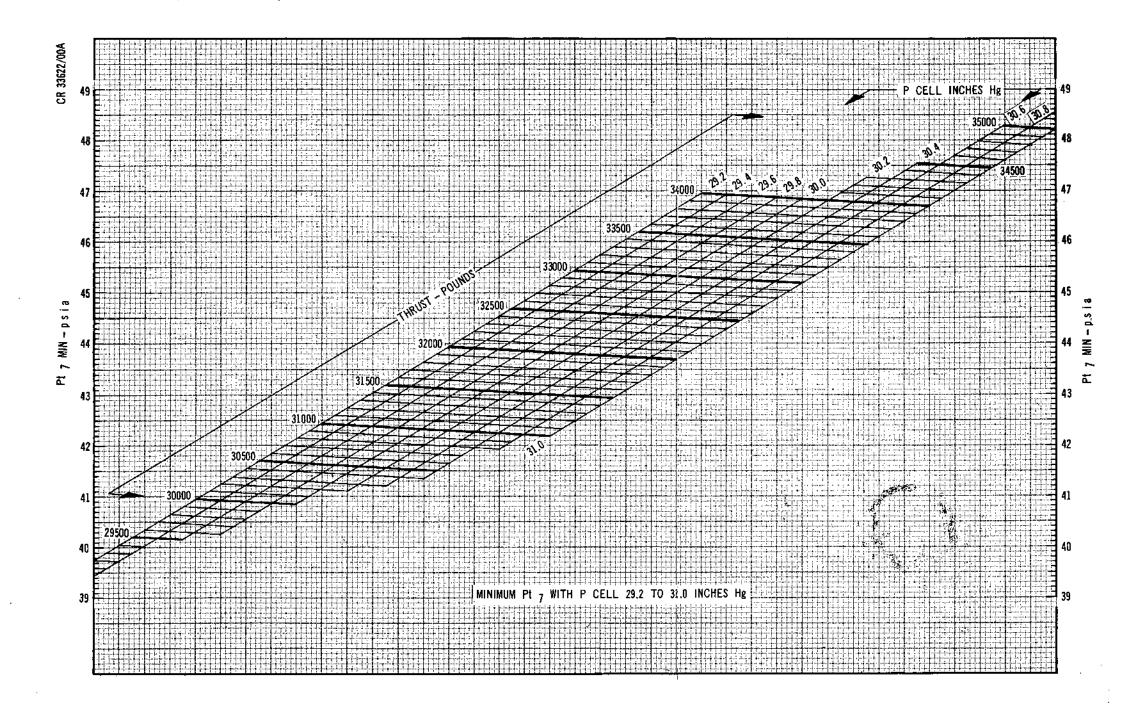
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Minimum Exhaust Annulus Total Pressure (Pt7) Figure 709 (Sheet 1 of 2)

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Minimum Exhaust Annulus Total Pressure (Pt7) Figure 709 (Sheet 2 of 2)

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